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(2)

ASSESSMENT OF AVIAN BOTULISM CONTROL  
PILOT PROJECT AT THE DIKE 14 CONFINED  
DREDGED MATERIAL DISPOSAL FACILITY,  
CLEVELAND, OHIO

AD-A231 729

by

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December 1990

Final Report

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Prepared for US Army Engineer District, Buffalo  
Buffalo, New York 14207-1399

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SECURITY CLASSIFICATION OF THIS PAGE

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REPORT DOCUMENTATION PAGE												
1a REPORT SECURITY CLASSIFICATION <u>Unclassified</u>		1b RESTRICTIVE MARKINGS										
2a. SECURITY CLASSIFICATION AUTHORITY		3 DISTRIBUTION/AVAILABILITY OF REPORT  Approved for public release; distribution unlimited.										
2b DECLASSIFICATION/DOWNGRADING SCHEDULE												
4 PERFORMING ORGANIZATION REPORT NUMBER(S)  Miscellaneous Paper EL-90-23		5 MONITORING ORGANIZATION REPORT NUMBER(S)										
6a. NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory	6b OFFICE SYMBOL (if applicable)	7a NAME OF MONITORING ORGANIZATION										
6c. ADDRESS (City, State, and ZIP Code)  3909 Halls Ferry Road Vicksburg, MS 39180-6199		7b ADDRESS (City, State, and ZIP Code)										
8a. NAME OF FUNDING/SPONSORING ORGANIZATION USAED, Buffalo	8b OFFICE SYMBOL (if applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER										
8c. ADDRESS (City, State, and ZIP Code)  Buffalo, NY 14207-1399		10 SOURCE OF FUNDING NUMBERS  PROGRAM ELEMENT NO      PROJECT NO      TASK NO      WORK UNIT ACCESSION NO										
11 TITLE (Include Security Classification) Assessment of Avian Botulism Control Pilot Project at the Dike 14 Confined Dredged Material Disposal Facility, Cleveland, Ohio												
12 PERSONAL AUTHOR(S) Simmers, John W.; Apfelbaum, Steven I.; Bryniarski, Len F.												
13a. TYPE OF REPORT Final report	13b TIME COVERED FROM _____ TO _____	14 DATE OF REPORT (Year, Month, Day) December 1990	15 PAGE COUNT 89									
16. SUPPLEMENTARY NOTATION  Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.												
17 COSATI CODES <table border="1"><tr><th>FIELD</th><th>GROUP</th><th>SUB-GROUP</th></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr></table>		FIELD	GROUP	SUB-GROUP							18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)  Avian botulism      CDF management	
FIELD	GROUP	SUB-GROUP										
19 ABSTRACT (Continue on reverse if necessary and identify by block number)  The Dike 14 Confined Dredged Material Disposal Facility (CDF) at Cleveland, OH, was the site of an avian botulism outbreak in 1986. At that time the use of noise-making devices was not successful in preventing the use of the CDF by shorebirds, wading birds, and waterfowl susceptible to botulism. The Buffalo District of the US Army Corps of Engineers identified the problem as one requiring a generic solution that could be applied at other operational CDFs. In a pilot project, plant propagules were planted at the CDF prior to the disposal operations so that a vegetative cover would rapidly appear as the CDF dewatered after disposal operations. The vegetation on the dewatering dredged material was expected to make the CDF unattractive to shorebirds, wading birds, and waterfowl. The pilot project was a qualified success in the prevention of a 1987 outbreak of avian botulism. The duration of the disposal operation and the depth of the dredged material placed in the CDF limited the anticipated vegetation establishment. However, the final elevation of the dredged material relative to the level of Lake Erie allowed the site												
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20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS		21 ABSTRACT SECURITY CLASSIFICATION Unclassified										
22a. NAME OF RESPONSIBLE INDIVIDUAL		22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL									

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

**19. ABSTRACT (Continued).**

to dewater and the vegetation that emerged attracted a terrestrial avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment. The procedures used to establish vegetation were feasible, compatible with dredging and disposal schedules, and cost-effective. A unique combination of equipment was required, but all of the components were relatively available.

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## SUMMARY

The Dike 14 Confined Dredged Material Disposal Facility (CDF) at Cleveland, OH, was the site of an avian botulism outbreak in 1986. At that time the use of noisemaking devices was not successful in preventing the use of the CDF by shorebirds, wading birds, and waterfowl susceptible to botulism.

The Buffalo District of the US Army Corps of Engineers identified the problem as one requiring a generic solution that could be applied at other operational CDFs. The following report describes a pilot project in which plant propagules were planted at the CDF prior to the disposal operations so that a vegetative cover would rapidly appear as the CDF dewatered after disposal operations. The presence of the vegetation on the dewatering dredged material was expected to make the CDF unattractive to shorebirds, wading birds, and waterfowl.

The pilot project was a qualified success in the prevention of a 1987 outbreak of avian botulism. The duration of the disposal operation and the depth of the dredged material placed in the CDF limited the anticipated vegetation establishment. The final elevation of the dredged material relative to the level of Lake Erie allowed the site to dewater and the vegetation that emerged attracted a terrestrial avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment.

The procedures used to establish vegetation were feasible, compatible with dredging and disposal schedules, and cost-effective. A unique combination of equipment was required, but all of the components were readily available.

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By _____	
Distribution / _____	
Availability Codes	
Dist	Average Factor Special
A-1	



## PREFACE

This work was sponsored by the Buffalo District of the US Army Corps of Engineers (CENCB). The work was conducted by the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS. The study was conducted under the direction of Dr. John Harrison, Chief of EL, and under the general supervision of Dr. C. R. Lee, Chief of the Contaminant Mobility and Regulatory Criteria Group, and Mr. Donald L. Robey, Chief of the Ecosystem Research and Simulation Division (ERSD).

The study was conducted by Dr. John W. Simmers of ERSD, Mr. Steven I. Apfelbaum of Applied Ecological Services, Juda, WI, and Mr. Len F. Bryniarski, Planning Division, CENCB. The CENCB Project Manager was Mr. Donald E. Borkowski.

Funding for the study was provided by CENCB. Technical reviewers were Drs. Douglas Gunnison and C. R. Lee, ERSD, and Dr. Gerould Wilhelm, The Morton Arboretum, Chicago, IL.

COL Dwayne G. Lee, CE, was the Commander and Director of WES at the time of the study. COL Larry B Fulton, EN, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

This report should be cited as follows:

Simmers, John W., Apfelbaum, Steven I., and Bryniarski, Len F. 1990. "Assessment of Avian Botulism Control Pilot Project at the Dike 14 Confined Disposal Facility, Cleveland, Ohio," Miscellaneous Paper EL-90-23, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

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## **CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT**

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square metres
cubic yards	0.7645549	cubic metres
Fahrenheit degrees	5/9	Celsius degrees*
feet	0.3048	metres
horsepower (550 foot-pounds (force) per second)	745.6999	watts
inches	2.54	centimetres
square inches	6.4516	square centimetres

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\* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula:  $C = (5/9)(F - 32)$ .

# ASSESSMENT OF AVIAN BOTULISM CONTROL PILOT PROJECT AT THE DIKE 14 CONFINED DREDGED MATERIAL DISPOSAL FACILITY, CLEVELAND, OHIO

## PART I: INTRODUCTION

### Background

#### Avian botulism

1. Botulism is a bacterial disease often associated with anaerobic conditions on mud flats. Six strains of the bacterium *Clostridium botulinum* that may cause illness have been identified by Duffus (1980).\*

2. Avian botulism is a common disease of waterfowl. The disease, also called limber-neck or Western duck sickness, usually occurs in shorebirds or wading birds congregating on emerging mud flats during the late summer. The causative organisms are bacteria of the genus *Clostridium* that multiply and produce a toxin in the bodies of dead invertebrate animals under anoxic conditions. *Clostridium botulinum* type C is the specific strain responsible for limberneck in shallow-water-dwelling, insect-feeding, and omnivorous birds. The bacteria are naturally present in sediments and soils, as spores. Under anaerobic conditions, mesophilic temperatures, and pH levels ranging from 5.7 to 8.0, the spores "germinate" and the bacteria multiply rapidly. It would appear that the appropriate conditions for the multiplication of the bacteria are often present in the hot late summer and early fall months (July-October). During this period, decaying vegetation or vertebrate and/or invertebrate animal carcasses may occur along shorelines and in shallow water providing a source of protein for the bacterial growth. As a carcass decays, the decomposition process uses up available oxygen in the carcass, producing anaerobic conditions. Bacterial spores, possibly ingested when the animal was alive, "germinate" after the animal's death. As the bacteria multiply, they release toxin. As the outbreak progresses, the presence of the carcasses of dead birds may provide additional sources of infection for unaffected birds. Birds may feed directly on invertebrate carcasses that contain the toxin. Alternatively, the birds may feed on live maggots of flesh flies or blowflies that lay eggs on dead vertebrates. These insects apparently accumulate *C. botulinum* toxin in their bodies as they feed on the carcasses. Some infected birds may carry the disease to neighboring wetlands and mud flats. Once a bird is infected, the botulism toxin attacks the parasympathetic nervous system and usually causes death.

3. Botulism bacteria are naturally present in waterways and widely distributed in organic soils. Avian botulism occurs in mud flats and in naturally occurring or manmade wetlands. While little is known about the occurrence or extent of botulism infections in naturally occurring wetlands, the incidence of the disease and the presence of dead and dying birds within confined dredged material disposal facilities (CDFs) are often singled out for attention by resource agencies and the general public. As a result, Corps of

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\* Duffus, J. H. 1980. *Environmental Toxicology*, John Wiley and Sons, New York.

Engineers Districts are often requested to take action after the disease is established. Frequently attempts to reduce the populations of susceptible species with noisemakers or trained raptors are both ineffective and expensive.

### CDF management

4. All CDFs progress through the same general stages. At first the dike is placed around an aquatic area. With filling, the enclosed aquatic area is replaced by a wetland and/or mud flat and, finally, an upland as the CDF is filled to capacity. At this point, control of the CDF is returned to the sponsor. Each of these stages requires management procedures appropriate to the habitat and the attracted wildlife. These management procedures are necessary to prevent the movement of contaminants, establishment of undesirable animal species, and wildlife diseases. CDF management must anticipate the possibility that avian botulism may occur at some time during CDF development. Should this event occur, the site must be managed to reduce or eliminate contact by populations of susceptible species.

5. In the US Great Lakes, CDFs contain dredged material contaminated with toxic metals, polychlorinated biphenyls, polyaromatic hydrocarbons, and other substances of industrial origin. Generally CDFs are located in waterways that are contaminated to some extent. There are no data that connect contaminants to avian botulism. The impacts of contaminant mobility and the potential incidence of botulism are apparently independent factors that must be considered in management of CDFs for wildlife usage.

6. The following report is a summary of a 1987 botulism control pilot project conducted at the Dike 14 CDF at Cleveland, OH, for the US Army Corps of Engineers Buffalo District (CENCB). The CDF was the site of an avian botulism outbreak in 1986 (Appendices A-D). During the pilot project, a vegetative cover was used to eliminate open mud flat areas that attract wading birds. The recommended management procedures contained in this report are intended to be compatible with CENCB maintenance and operations procedures and are generically applicable to other Districts and locations. A botulism control management plan developed for the Saginaw Bay CDF in Saginaw, MI, is included as Appendix E.

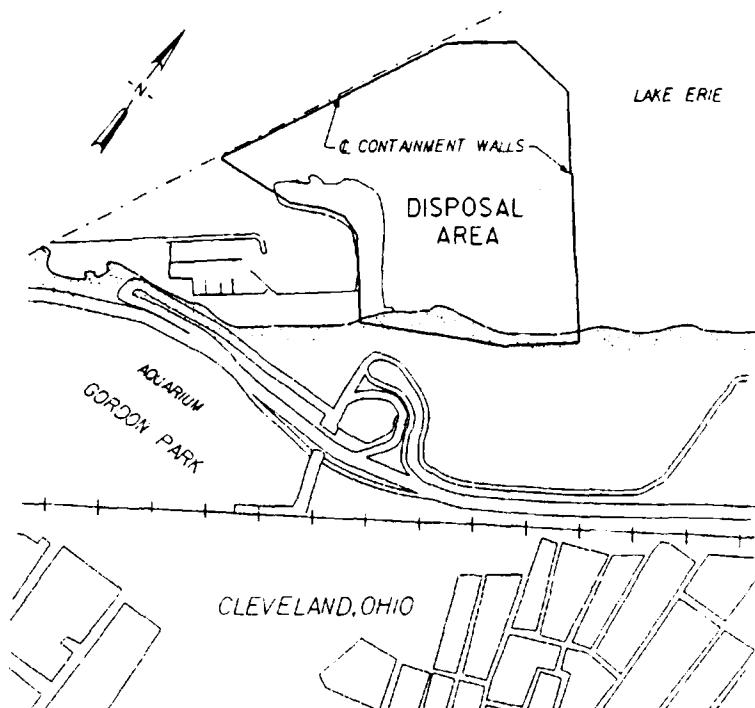
### Dike 14 CDF

7. The Dike 14 CDF is an endiked disposal facility of approximately 80 acres\* projecting into Lake Erie in the Cleveland Harbor (Figure 1). The CDF is divided into east and west portions by the culvert that transfers Doan Brook through the CDF to the lake (Figure 2 and Photo 1). The CDF contains dredged material from the Cuyahoga River and the Cleveland outer harbor. Yearly maintenance dredging operations typically result in the placement of approximately 320,000 yd<sup>3</sup> of dredged material into the site. One third of the material is dredged from the outer harbor and two thirds of the material is dredged from the heavily contaminated Cuyahoga River. The site is currently filled to between 50 and 60 percent of capacity. Doan Brook culvert physically divides the site into two cells and rests on stone rubble requiring the hydrostatic pressure to be balanced on both sides.

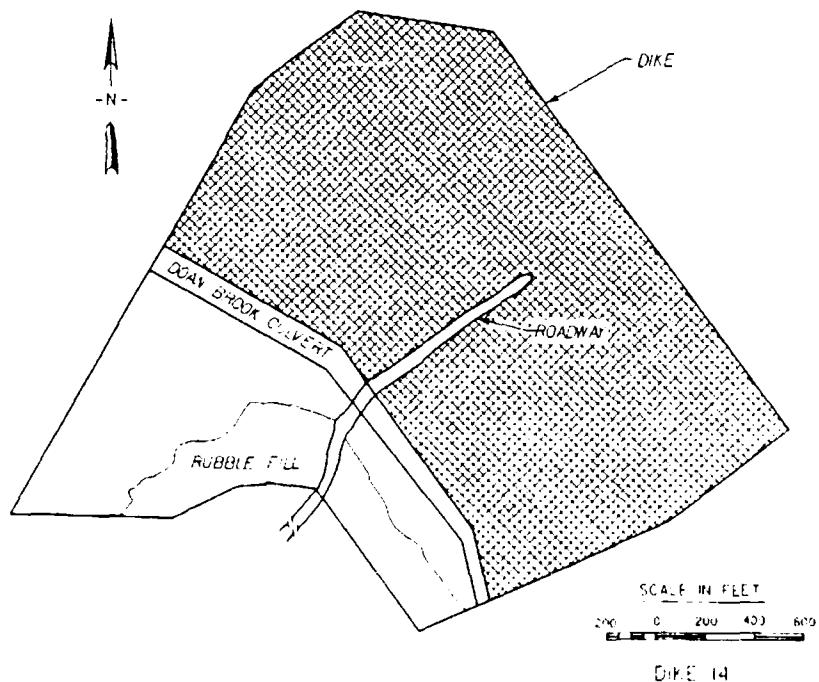
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\* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page iv.

**Figure 1.** Location of the Dike 14 CDF in the Cleveland, OH, metropolitan area.



**Figure 2.** The Dike 14 CDF (the shaded area was the site of the avian botulism abatement pilot project)



Therefore, the differential in the levels of dredged material slurry on either side could not exceed 1 ft until the site had been filled to a depth sufficient to bury the culvert.

8. During 1986, the filling of the site reached the point that there were extensive areas of shallow water in the CDF. As the dredged material dewatered, areas of anaerobic mud flat were exposed, the mud flats attracted large numbers of birds, and an avian botulism

incident occurred. Lists of the species killed in the September 1986 outbreak are included in Table 1 and Appendix A.

### **Methods of control**

9. Hunter et al.\* extensively studied botulism in California and summarized techniques that have been used to reduce the severity of outbreaks. These methods are based on improvement of ponds and generally involve the maintenance of controlled water levels to minimize the presence of mud flats. Other approaches have included use of carbide cannons or other noisemakers, falconry, and effigies of predators to keep birds away, and removal of dead and/or infected birds to reduce sources of infection. All methods mentioned, while effective to varying extents, are neither compatible with the logistics of a typical maintenance dredging schedule nor easily converted to a standard operating procedure.

### **Objectives**

10. The objectives of the pilot project were:
  - a. To demonstrate the use of vegetation to discourage waterfowl and shorebirds from landing on the site, reducing the incidence of avian botulism at CDFs.
  - b. To demonstrate the feasibility of the above approach as a standard operating procedure.
  - c. To evaluate the results of the approach when applied to a regularly scheduled dredging and disposal operation.

### **Approach**

11. The techniques that have been suggested and/or applied to reduce the incidence of avian botulism have not been compatible with the operational requirements of a Corps of Engineers District. A District's dredging operations involve one or more contractors, and often several waterways must be dredged. There are also seasonal, construction, and/or environmental restrictions (or constraints) that must be met. Therefore, it is not possible to schedule the placement of dredged material into each CDF at the optimum period for the safety of all waterfowl and shorebird species that are attracted to the site.

12. CDF management usually does not consider the selection or control of colonizing species. As a result, birds are frequently attracted to new habitats provided by CDFs. Birds attracted to early successional habitats may develop dense populations on mud flats. Certain threatened and endangered species attracted to mud flats may also colonize contaminated sites in contaminated waterways. These are also locations where conditions favorable to the spread of naturally occurring diseases may temporarily occur.

13. The management of a CDF must be a continuing process that is based on the anticipation of the sequence of events that occur in the transition of the CDF from an

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\* Hunter, B. F., Clark, W. E., Perkins, P. J., and Coleman, P. R. 1970. "Applied Botulism Research Including Management and Recommendations - A Progress Report," Wildlife Management Branch, California Department of Fish and Game, The Resources Agency, Sacramento, CA.

aquatic to a terrestrial ecosystem. The reduction of the incidence of avian botulism is one goal of management; however, the processes managed cannot be separated from the other processes that occur at the CDF. It is critical that any habitat, either naturally occurring or specifically created, must be evaluated by answering the following questions:

- a. Which species will be excluded?
  - b. Which species will be attracted?
  - c. Will there be significant seasonal differences in species? (i.e., will the mud flat used for nesting by an endangered species in the spring be the site of botulism in late summer?)
  - d. Are the habitats selected for pathogen abatement consistent with the management of the CDF to reduce contaminant mobility?
  - e. Will a species be attracted that may be adversely affected by the area surrounding the CDF? (i.e., will species attracted to the CDF dike for nesting be adversely impacted by feeding in a nearby industrial area?)
14. Plant species were established in the areas of the Dike 14 CDF where it was anticipated that shallow water would exist after the 1987 dredging operations. The naturally occurring dewatering during late summer and early fall could contribute to a potential botulism problem. The plants introduced prior to the disposal operations were expected to colonize or emerge through the mud flats as the dredged material dewatered. The vegetated mud flats were expected to be unattractive to the wading birds susceptible to botulism, and to attract a diverse upland avifauna that would neither be susceptible to botulism nor adversely impacted by contaminants due to habitat and feeding preferences. All efforts to modify the postdisposal habitat with vegetation were applied without requiring either costly or time-consuming modifications in the CENCB operations schedule.

## PART II: METHODOLOGY

### Plant Species

15. A mix of plant species was selected to provide initial and long-term cover on the east side of the culvert (Figure 2). Annual grasses and wetland species were used to create the early successional conditions needed to enable the development of perennial species. These species were planted as seeds, roots, or stem cuttings (Table 2). Common reed (*Phragmites australis*) and sandbar willow (*Salix interior*) were planted as rhizomes and twig cuttings, respectively. All species chosen have either been found within the CDF (Table 3), or are commonly found in disturbed wetlands, and can produce dense vegetative cover.

16. The reed rhizomes were harvested at the Consumers Power Plant, Karns coal-fired electrical generating plant in Bay City, MI. Rhizomes were collected from a graveled road shoulder with a 3-point-hitch spring harrow attached to a 70-hp four-wheel-drive tractor. The tines of the spring harrow cut and lifted the dense rhizome mass from the gravel base. The rhizomes were then cut into 4- to 6-in. lengths, iced, packed in peat moss and stored in Styrofoam chests. The rhizomes were stored at Applied Ecological Services facilities (Juda, WI) at  $44\pm2^{\circ}$  F for the 2-week period between collection and planting at Dike 14.

17. Willow cuttings were collected near Brodhead, WI, 2 days before planting at Dike 14. The willow was collected as whips 6 ft in length. After collection, half of the willow whips were cut to 1-ft lengths. All cuttings were packed on ice in Styrofoam chests until planting.

### Equipment

18. Specialized equipment was assembled for planting seeds, cuttings, and rhizomes at Dike 14. A four-wheel-drive Honda all-terrain vehicle (ATV) fitted with rubber half-tracks (Tracker Industries) was used in planting areas containing standing water and/or unconsolidated dredged material (Photos 2 and 3). Loading rates of the ATV, plant material, and driver were 0.3 to 0.7/sq in. Seeding was accomplished with a 3-bushel cyclone seeder driven by a 5-hp Briggs and Stratton engine carried on the ATV. Rhizomes and 1- and 6-ft willow cuttings were planted by hand from the ATV.

19. A four-wheel-drive Pasquali tractor, with dual wheels, was used in the more consolidated areas to plant reed rhizomes and willow cuttings (Photos 4 and 5). A 3-point-hitch strawberry planter was modified and attached to the tractor as a single row planter. The planter's colter disc opened substrates for insertion of rhizomes and cuttings and packing wheels pressed the substrate around the plant materials. Rhizomes or cuttings could be planted at the rate of up to 3,000/hr.

20. A draw-bar-mounted spring harrow was used to rip the surface 3 to 4 in. of the consolidated substrate at the 1986 botulism problem area, and in the relatively dry south end of the CDF (Photo 6). This tool produced a corrugated seed bed and incorporated the seed into the upper inch of the substrate. A 7.5-ft tined drag was pulled by the ATV in areas too wet to harrow in order to provide microtopographic relief for seed incorporation.

### **Planting Schedule and Rates**

21. Planting was initiated 18 May and completed 21 May 1987. Seeding rates (lb/acre) and the approximate numbers of cuttings and rhizomes are shown in Table 2. The seed mix was homogenized by hand in the hopper of the seeder and then spread at a uniform rate. A 30- to 40-ft seed spread width was typical and provided relatively uniform coverage.

## **PART III: RESULTS AND DISCUSSION**

### **Planting Strategy Feasibility**

22. Three days were required for a crew of five persons to collect and prepare the propagules, and 4 days, 17-21 May 1987, were required for planting by two persons. Five hours were required to till the consolidated portions of the CDF (approximately 20 acres). Seeding required roughly 10-15 min per acre including loading, seed mixing, and spreading. Rhizomes and cuttings were planted at rates of 800 to 3,000 plants per hour depending on the substrate conditions.

23. The dredged material along the northern edge of the dike was neither drivable nor walkable and was covered by 1 to 3 ft of water. The unconsolidated material in this area clogged the ATV track grousers and the vehicle buried itself. Use of a winch and cable to pull the ATV was sufficient to permit planting activities in unconsolidated areas. Prevailing winds and waves were also used to distribute propagules in ponded areas.

### **Dredging Operations**

24. Dredged material disposal operations began 29 May 1987, 8 days after the completion of planting, and continued through 31 July. The dredging contractor, Great Lakes Dredge and Dock, placed 320,000 yd<sup>3</sup> of dredged material in the CDF; 220,000 yd<sup>3</sup> were dredged from the Cuyahoga River and the remaining 100,000 yd<sup>3</sup> were from the Cleveland outer harbor. The unplanted portion of the site (approximately 35 acres west of the Doan Brook culvert) was filled first (Figure 2). Dredged material was then alternately pumped to the east and west halves to maintain equal hydrostatic pressure on the culvert ( $\pm 1$  ft). Within a month, the dredged material completely overflowed the culvert. By the time the disposal operations were completed, most of the planted area east of the culvert was covered by up to 6 ft of dredged material, or was flooded.

25. By 2 September the CDF had dewatered and the dredged material consolidated. The Doan Brook culvert was covered, there were no shallow areas of standing water to attract wading birds, and there were no indications of avian botulism. Some planted vegetation had emerged through the dredged material.

26. The pilot project was evaluated at the end of the growing season (26 October 1987). During the disposal operations the CDF was filled level with the culvert. The north end of the east half (planted) and the west half (unplanted) of the CDF each received up to 6 ft of dredged material. In the east half of the CDF, depths of dredged material decreased with increased distance from the dredge pipe. The gravel access road in the east half of the CDF supported lush vegetation that apparently acted to filter suspended material so that the south 30 acres of the east half experienced only intermittent flooding.

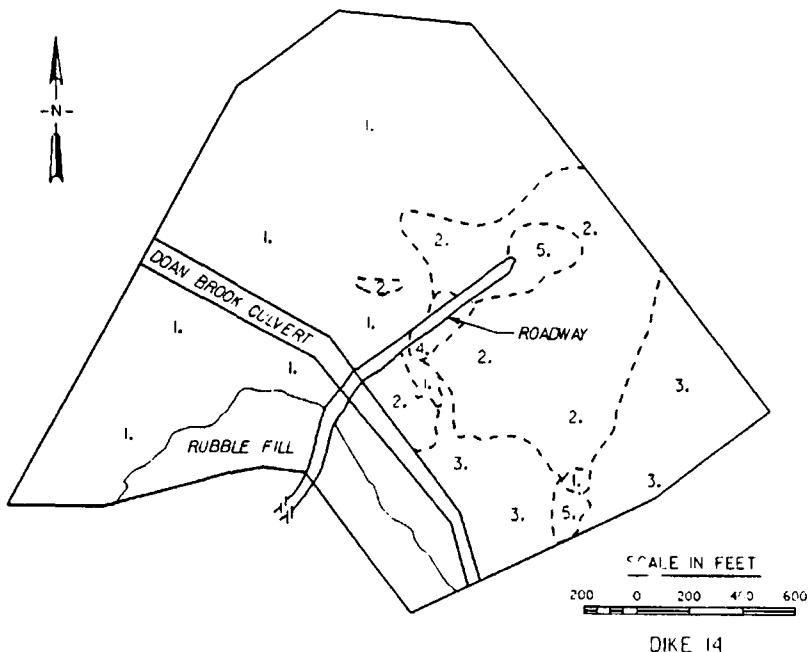
### **Vegetation**

27. Vegetation was not established during the 1987 growing season in areas where deep burial occurred (Photo 7). Only vegetation capable of growing through shallow burial was evident in October (Figure 3 and Photo 8). Smartweed species were able to sprout adventitious roots along the stems and incrementally grew through over 3 ft of

Figure 3. Vegetation at the  
Dike 14 CDF  
26 October 1987

Key:

1. Dry mud flat, unvegetated
2. Dominant plant,  
smartweed (*Polygonum*)
3. Dominant plant  
barnyard grass  
(*Echinochloa*)
4. Dominant plant  
giant reed (*Phragmites*)
5. Dominant plants  
cottonwood (*Populus*) and  
willow (*Salix*)



dredged material. In areas of shallow dredged material deposits, smartweed and barnyard grass were present in dense stands. Interspersed in these stands were reeds and willow from the spring planting.

28. Seeds of smartweed and barnyard grass littered the substrate throughout the CDF. The seeds in and on the substrate produced by the vegetation planted in 1987 germinated in spring 1988, and by 26 June 1988, 75 percent of the site was vegetated (Photo 9). The reed and willow propagules expected to emerge in 1988 were not evident, and the vegetation was composed mainly of grasses and cattails with isolated stands of reed and willow. Observations made 31 August, after disposal operations were completed, indicated that smartweed was the most prevalent species. Areas of *Phragmites* and willow had expanded, and approximately 75-80 percent of the CDF was vegetated (Photo 10). On 31 August there was no standing water on the site and the only shorebirds or waterfowl present were gulls resting in the dry but unvegetated area left by the most recent (1988) disposal operations.

29. It is interesting to note that, while areas of comparably sized willows and cottonwoods were partially buried by the dredged material, only the willows survived.

#### Avifauna

30. The combination of increased dredged material elevation relative to the lake level and the dense growths of planted and volunteer grasses and forbs substantially changed the bird habitat. Foraging shorebirds and waterfowl were no longer the most numerous birds at the CDF. Bird watchers at the CDF noticed a shift in the avifauna to species of sparrows, finches, other songbirds, and doves. These bird groups generally feed on seeds or terrestrial insects and therefore do not usually contract avian botulism. Detailed lists

of species have been compiled by the local Cleveland bird watchers. The observations of one volunteer bird bander confirm the magnitude of the change. Jerry Talkington, a volunteer bird bander for the US Fish and Wildlife Service, banded a great many shorebirds and only about 100 sparrows at Dike 14 in 1986. In fall 1987, in 1 day, almost 400 sparrows were banded and by 26 October 1987, Mr. Talkington had banded 17 different sparrow species (Photo 11). William A. and Nancy R. Klamm of Lakewood, OH, have maintained detailed records of the birds observed at Dike 14. Their records for 1986, 1987, and 1988 through September are included as Appendix D. These records document the changes in avifauna visitations that have occurred with the filling of Dike 14 and the related vegetational changes. The Klamm's records confirm the changes in avifauna from various lakeshore-related species to upland birds that have accompanied the filling of the CDF. In particular, long-term records such as these document the presence of stages of finite length or "windows" in the life cycle of a CDF when management of colonizing species may be necessary.

## **PART IV: CONCLUSIONS AND RECOMMENDATIONS**

31. The pilot project was a qualified success in the establishment of vegetation at Dike 14. The duration of the disposal operation and the depth of the dredged material limited the anticipated vegetation establishment. The final elevation of the dredged material relative to the lake level allowed the site to dewater rapidly and the vegetation attracted a different avifauna. The observed botulism abatement was the result of both additional filling and vegetation establishment.
32. The procedures used to establish vegetation were feasible and cost-effective. A unique combination of equipment was required, but all of the components were readily available.
33. Ideally, division of a CDF into two cells would permit the use of one cell for disposal while vegetation developed on the other. This would allow both cells to be vegetated during the critical stage in CDF development when shallow water and mud flats are the only features present. This approach is often not possible due to construction or operational constraints. Therefore, it is critical that the botulism "window" is identified and action is taken before the first outbreak. At Dike 14, an effort to establish emergent vegetation would have been most effective in the spring of 1986.
34. The procedures applied at Dike 14 require fine tuning before they can be considered standard operating procedures. The procedures can be further defined through application at other CDFs where conditions that favor botulism can occur.
35. The pilot project described was a field test of methodology that could contribute toward either preventing or reducing the potential of avian botulism outbreaks at CDFs.

**Table 1**  
**Birds Killed in the September 1986 Avian Botulism Outbreak**

<u>Number Dead</u>	<u>Common Name</u>	<u>Species</u>
13	Semipalmated plover	<i>Charadrius semipalmatus</i>
12	Spotted sandpiper	<i>Calidris sp.</i>
7	Sanderling	<i>Calidris alba</i>
3	Pectoral sandpiper	<i>Calidris melanotos</i>
2	Least sandpiper	<i>Calidris minutilla</i>
2	Ruddy turnstone	<i>Arenaria interpres</i>
2	Mute swan	<i>Cygnus olor</i>
1	Stilt sandpiper	<i>Micropalama himantopus</i>
1	Lesser yellowlegs	<i>Tringia flavipes</i>
1	Knot	<i>Calidris canutus</i>
1	Canada goose	<i>Branta canadensis</i>
1?	Mallard	<i>Anas platyrhynchos</i>
1?	Ring-billed gull	<i>Larus delawarensis</i>

NOTE: List compiled from data provided by the Cleveland Museum of Natural History, a more extensive description of the outbreak and list of bird species involved is given in the US Fish and Wildlife Service Columbus Field Office Report included as Appendixes A-D. The total number of dead birds was estimated to be between 687 and 716.

**Table 2**  
**Species Selected for the Vegetation of the Dike 14 CDF**

<u>Common Name</u>	<u>Species</u>	<u>Planting Rate per Acre for 45-Acre CDF</u> <u>lb/acre</u>
Italian rye grass	<i>Lolium multiflorum</i>	11.00
Bentgrass	<i>Agrostis sp.</i>	0.90
Bulrush	<i>Scirpus atrovirens</i>	0.10
Wool grass	<i>Scirpus cyperinus</i>	0.10
Barnyard grass	<i>Echinochloa crusgalli</i>	20.00
Smartweed	<i>Polygonum pensylvanicum</i>	5.00
Reed canary grass	<i>Phalaris arundinaceae</i>	2.00
Rice cutgrass	<i>Leersia oryzoides</i>	0.04
Switchgrass/Cocklebur	<i>Panicum virgatum Xanthium</i> sp. mixture	0.40
Common reed	<i>Phragmites australis</i>	3,350 rhizomes
Sandbar willow	<i>Salix interior</i>	3,350 cuttings

**Table 3**  
**Inventory of Plant Species Present on the Dike 14 CDF**  
**Estimates Made February 1987**

<u>Common Name</u>	<u>Species</u>	<u>Percent Cover</u>
<i>Mudflat Area</i>		
Cocklebur	<i>Xanthium strumarium</i>	<20 to <5
Shepherd's purse	<i>Capsella bursa pastoris</i>	
Barnyard grass	<i>Echinochloa crusgalli*</i>	
American wormseed	<i>Chenopodium ambrosioides</i>	
Beggar's ticks	<i>Bidens</i> sp.	
Smartweed	<i>Polygonum lapathifolium</i>	
<i>Coarse-grain-size material</i>		
Sandbar willow	<i>Salix interior*</i>	50-100
Cottonwood	<i>Populus deltoides*</i>	
Reed canary grass	<i>Phalaris arundinacea*</i>	
Common reed	<i>Phragmites australis*</i>	
Purple Loosestrife	<i>Lythrum salicaria</i>	
Rice cutgrass	<i>Leersia oryzoides*</i>	
Cocklebur	<i>Xanthium strumarium</i>	
Love grass	<i>Eragrostis hypnoides</i>	
Bog rush	<i>Juncus</i> sp.	
Aster	<i>Aster pilosus</i>	
<i>Fine-grain-size material</i>		
Broad-leaved cattail	<i>Typha latifolia</i>	100
Narrow-leaved cattail	<i>Typha angustifolia</i>	
Common reed	<i>Phragmites australis*</i>	
Buttercup	<i>Ranunculus rhomboideus</i>	
Bog rush	<i>Juncus</i> sp.	
Three-square	<i>Scirpus americanus</i>	
Smartweed	<i>Polygonum lapathifolium</i>	

\* Species selected for site vegetation.



Photo 1. Dike 14 CDF. The concrete structure on the right is the Doan Brook culvert that divides the Dike 14 CDF into east and west portions. The west portion is shown in this photograph. The CDF dike is in the background

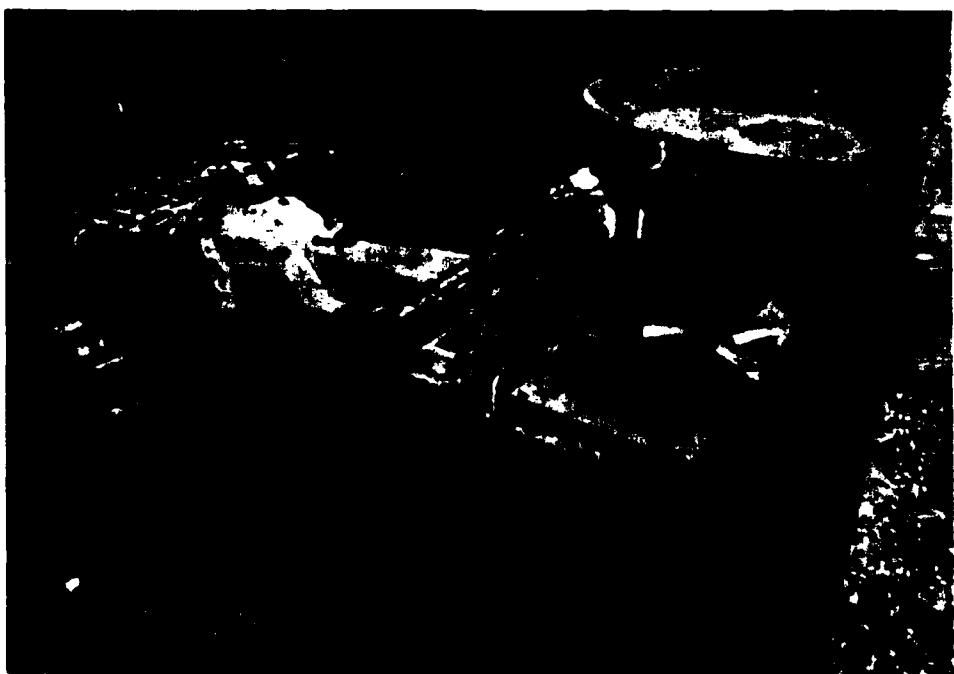


Photo 2. The Honda ATV with half tracks as used in the pilot project. The 3-bushel cyclone seeder is mounted on the ATV. This equipment was used in planting unconsolidated mud flats and ponded areas



Photo 3. The Honda ATV operating in water depths of 1-2 ft



Photo 4. The four-wheel-drive articulated Pasquali tractor with dual wheels  
as used in the pilot project

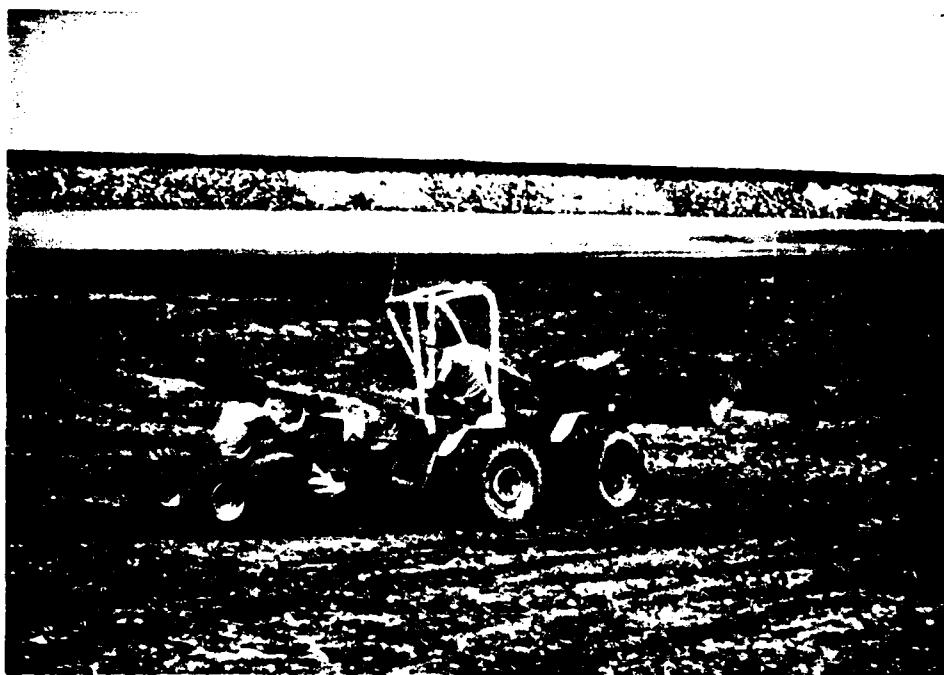


Photo 5. A three-point-hitch modified strawberry planter was used with the Pasquali tractor to plant cuttings and rhizomes in the relatively consolidated portions of the CDF



Photo 6. A 30-hp four-wheel-drive Pasquali tractor was used to pull a modified spring harrow to break up consolidated surface material before planting. This equipment could only be used in the drier areas of the CDF



Photo 7. Planted areas receiving 3-6 ft of dredged material had not become well vegetated by 26 October 1987. There were, however, no areas of standing water and no botulism reported



Photo 8. Planted areas receiving 1 ft of dredged material or less produced relatively lush vegetation in the short time between the completion of the disposal operations and the end of the growing season



Photo 9. Vegetation at Dike 14 during disposal operations (June 1988)



Photo 10. Vegetation at Dike 14 at maximum vegetational growth, September 1988.  
As in October 1987, there were no areas of standing water and the site was  
not used by bird species susceptible to avian botulism



Photo 11. Dense grass and forb vegetation substantially changed the bird habitat. Volunteer bird banders captured, marked, and released many seed-eating birds and a few wading birds in 1987. During fall 1987, sparrows representing 17 species were banded

**APPENDIX A  
US FISH AND WILDLIFE SERVICE REPORT  
ON THE 1986 AVIAN BOTULISM OUTBREAK  
AT DIKE 14**

## An Account of the Botulism Outbreak at the Cleveland, Ohio Confined Disposal Facility in 1986

by William J. Kurey, US Fish and Wildlife Service, February 1987

*Closteridium botulinum* type C is the bacterium that produces the toxin responsible for mass waterfowl deaths. There are six different strains of this bacterium labeled A through F on the basis of the neurotoxins they produce. The disease known as avian botulism, western duck sickness, or limberneck is caused by the neurotoxin, not by bacterial infection.

Botulism tends to ignite in areas that have not been recently flooded or where water levels fluctuate along a feather edge shore (as in Cleveland CDF). Other conditions conducive to a botulism outbreak include:

- a. Warm temperatures - 60° to 90° F (winter botulism outbreaks are thought to be caused by still-active toxin produced under warm conditions earlier).
- b. pH of 5.7 to 8.0.
- c. Suitable nutrient medium consisting almost entirely of animal matter.
- d. Vertebrate as well as invertebrate carcasses.

Flooding of dry land drowns terrestrial invertebrates that then become incubators for the anaerobic botulism bacteria. Botulism can be a problem in water depths up to about 18 in. The decomposition process uses up available oxygen, and bacterial spores ingested during the life of the animal germinate after death. Botulism outbreaks begin when birds feed directly on invertebrate carcasses or live invertebrates containing toxin and are killed, thus providing additional places for *C. botulinum* to grow. The outbreak gathers momentum as maggots and other invertebrates concentrate toxin from bird carcasses on which they have been feeding. Ingesting just two to five of these toxin-bearing maggots can kill a duck and more than 5,000 maggots can be produced by a single duck carcass. Once an outbreak occurs it is necessary to remove waterfowl carcasses to break the fly/maggot cycle.

The only positive diagnosis is a laboratory procedure using mice and antitoxin. Signs of botulism intoxication in waterfowl include:

- a. Sick birds are of normal weight.
- b. Sick birds don't eat.
- c. Sick birds have trouble holding their head erect, hence the term limber neck. Leg weakness and wing droop progresses to flaccid paralysis. The nictitating membrane over the eye ceases its rhythmic functioning.

Some sick birds can recover from botulism if given the opportunity. There are three stages of the disease:

- Class 1. Birds that can walk but not fly. These birds can recover without special treatment.

Class 2. Birds that suffer a greater degree of paralysis; difficulty walking and usually row their wings. These birds may recover with oral administrations of fresh water.

Class 3. These birds are almost completely immobilized and require intraperitoneal injection of antitoxin to survive.

The Cleveland confined disposal facility (CDF) is a diked enclosure for sediments dredged from the harbor to maintain navigable depths. It is known as Dike 14 to the US Army Corps of Engineers and covers an area of about 88 acres. The northwest lagoon is about 9 acres in size and contains open water over 3 ft deep. Cattail marsh and shallow water areas fringe the south shore of this lagoon. The large east lagoon is about 55 acres in size with several acres of brushy vegetation in the central area: the rest is unvegetated sediment, some hard enough to walk on but mostly mud. Open water, from 10 in. deep along the north dike feathering to 0 in. southward, covered about 10 to 15 acres. The depth and extent of this ponded water varied with the elevation of Lake Erie due to the permeability of the dikes. It was this area that appeared to be the source of the botulism problem, although some carcasses were also found in areas of the west lagoon.

According to Bill McDonald (Buffalo District), prior to the summer of 1986 the east lagoon was full of water. Indeed, aerial photographs of the CDF taken in March or April of 1986 show it was covered with water except for a relatively small area in the center of the east lagoon. He also mentioned that he thought that the amount of sand in the dredged sediments was greater in earlier years.

Botulism does not appear to have been a problem at the Cleveland CDF prior to 1986. However, there have been outbreaks at the Saginaw, MI CDF and the Toledo, OH CDF in previous years.

The US Fish and Wildlife Service (USFWS) involvement in the botulism outbreak began on August 12, 1986, but the problem might have existed for 2 weeks or more before USFWS personnel were informed. The problem was brought to the attention of the USFWS by Mr. Dick Bartz of the Ohio Department of Natural Resources (ODNR) who was advised by an employee that he and local bird watchers had noticed the birds dying in the Cleveland CDF.

On August 14, the USFWS met on site with representatives of the Ohio Division of Wildlife (ODOW), ODNR, and the Army Corps of Engineers. The Corps agreed to collect and dispose of carcasses and to try to scare the birds. The ODOW provided a propane cannon that day; eventually, there were four at our disposal.

On the day of the meeting we counted about 65 carcasses using binoculars and a spotting scope; mostly shorebirds were observed, perhaps 15 percent were ducks and geese. A few shorebirds were alive in varying stages of paralysis and displaying typical signs of botulism intoxication. Sick birds tried to hide under vegetation, and those that could not reach shelter died on the mud flats and were not retrievable. The broad expanse of mud flats was the complicating factor in all of this. There was no way to cross the mud to search for dead birds.

The USFWS returned on August 18 and 19 with two 12-gauge shotguns and cracker-shells for frightening off the birds. The USFWS scared birds and left this equipment with

the Corps for their use. Two cases of crackershells (1,000 rounds) with a replacement value of over \$500 were expended over the 46 days they were in use. Eight shorebird carcasses were picked up for submission to the National Wildlife Health Center (NWHC) for necropsy. By September 4, the NWHC had confirmed type C botulism as the cause of death.

The Corps reluctantly agreed to use the propane cannons because of disturbance complaints from a residential area. The propane cannons appeared to be effective in keeping ducks and geese out of the CDF, but shorebirds were unimpressed. Shorebirds were also unimpressed by the use of reflective tape, and even crackershells served to move them only short distances on most occasions. A good deal of the area used by shorebirds (the mud flats) was out of range of the crackershells. The dike walls are hazardous to walk over and could not be used to access remote parts of the CDF.

The USFWS made several more trips to the CDF on August 22, August 29, September 4, and September 10. On August 29, Mr. Bill Kurey of the USFWS Columbus office was interviewed for television about the situation. On a later trip, a fishing rod and reel were employed to retrieve some dead birds that were out of reach (treble hook on the end and several split shot sinkers just in front of it). An attempt was made to use a boat to retrieve carcasses which was effective on the west lagoon but unsuccessful in the east because declining water depth make boat launching impossible. Between August 12 and 29, lake level (and therefore CDF level) decreased 4 in.

Records of CDF water temperature range from 73° to 36° F in the east lagoon during the times measured. Oxygen levels in the west lagoon ranged from 12.2 - 12.8 ppm at the surface to 8.0 - 9.5 ppm at the 3-ft depth on the only day measurements were taken. Good measurements were impossible in the east lagoon because of shallowness and inaccessibility. The east lagoon was well mixed by wind, and high oxygen levels would have been expected. It is suspected that the east lagoon would have very little oxygen in the water after several days of calm weather and high temperatures. However, the oxygen level in standing water may have little significance to the progress of the botulism bacteria. These bacteria thrive primarily in the moist mud zone between the water's edge and the dry soil, an area free of the diluting and heat-insulating effects of the water. Reflooding makes this botulism-laden area attractive to waterfowl.

On August 24, contractors were engaged by the Corps to take over the job of scaring birds and searching for carcasses. These efforts continued until October 3. Good records are available of the number of birds collected daily from August 24 to Oct 3 (41 days). Although weather conditions or other factors affected collections on some days, it is felt that the number of carcasses collected was an accurate indication of the relative numbers of birds dying from botulism (especially when taken on a weekly basis). These collections were a relative number because an unknown number of the birds died in the mud and could not be retrieved.

A total of 543 dead birds were collected over a period of 41 days. Counts of the earlier mortality add 143 (Corps count) to 173 (USFWS count) to this number. Therefore, we know that from 687 to 716 birds died; but the real number could be higher by several hundred owing to the difficulty presented by the mud flats in getting an accurate count.

Most of the affected birds (a crude estimate is 90 percent) were shorebirds the size of sandpipers, very small and easily overlooked, and this was another complicating factor.

The following list of some birds in the Cleveland CDF area was made by Ann Bugeda (Lake County Metropolitan Parks) on August 19:

Observed Dead	Observed Alive
Canada goose	Semipalmated sandpiper
Mallard	Semipalmated plover
Ring-billed gull	Ring-billed gull
Semipalmated sandpiper	Lesser yellowlegs
Semipalmated plover	Pectoral sandpiper
	Black-bellied plover
	Bonapartes gull
	Herring gull
	Killdeer
	Mute swan
	Sandpiper sp.
	Great blue heron
	Green heron
	Red-winged blackbird
	Flicker
	Swallow sp.

The two mute swans could not be scared out of the area and eventually died. Some other species were also in the area, including what might have been a falcon (species unknown) which was observed to stoop on a distant group of shorebirds causing them to rise and move out of the area, and the Federally endangered piping plover. The source of the piping plover report also saw marbled godwits, lesser golden plover, and red phalarope in early September. This person was a bird bander who had encountered a total of three piping plover at the CDF in 1986. He saw one in April or May, and two in early August which were sick with botulism. These two birds were banded and nursed back to health by force-feeding flies with tweezers. They were released at Lake Rockwell near Kent, OH, on September 24.

The botulism problem at Cleveland lasted from prior to August 12 to October 3 - about 44 days. About 700 migratory birds, mostly shorebirds, are known to have perished. The Federally endangered species piping plover was among the shorebirds involved, although there was no mortality.

The conditions that led to the 1986 botulism outbreak in Cleveland could exist again in 1987. In order to try to avoid these conditions, the Corps plans to maintain more of a slope on the CDF from the point where sediment filling occurs, and possibly to dredge later in the season to maintain the water level in the CDF. It is expected that up to 300,000 yd<sup>3</sup> of sediment could be added to the CDF in 1987.

Mr. John Simmers of the US Army Engineer Waterways Experiment Station in Vicksburg, MS, has suggested that Phragmites sp. might be planted in the CDF to aid

dewatering and make the area unattractive to shorebirds. The Buffalo District has made no decision on this proposal yet.

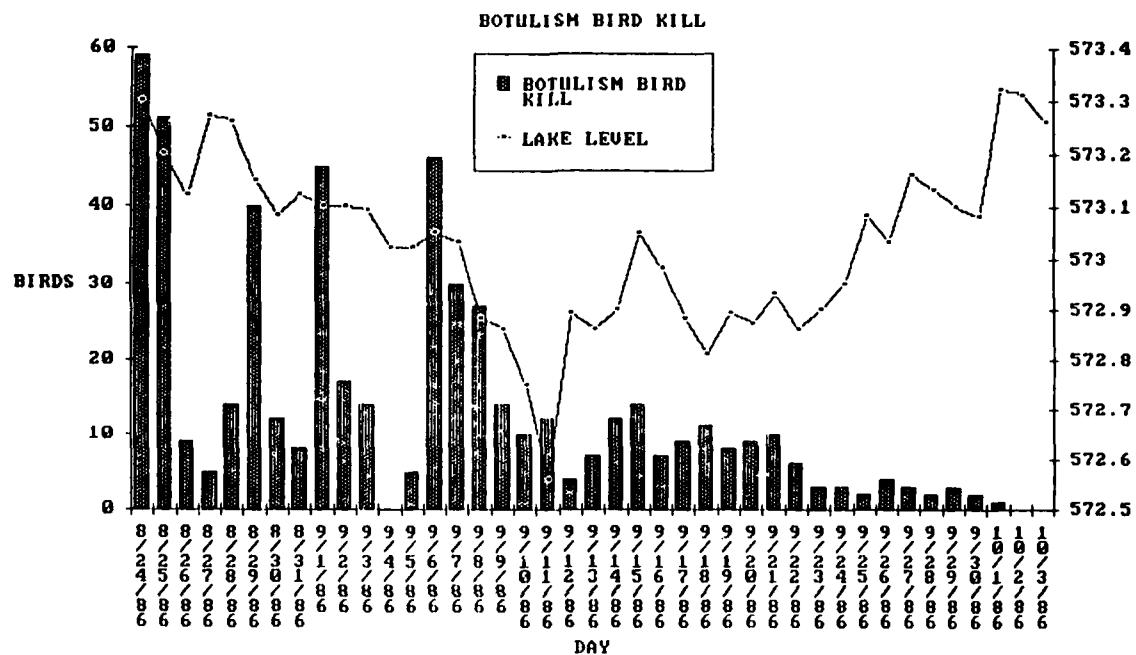


Figure A1. Botulism bird kill

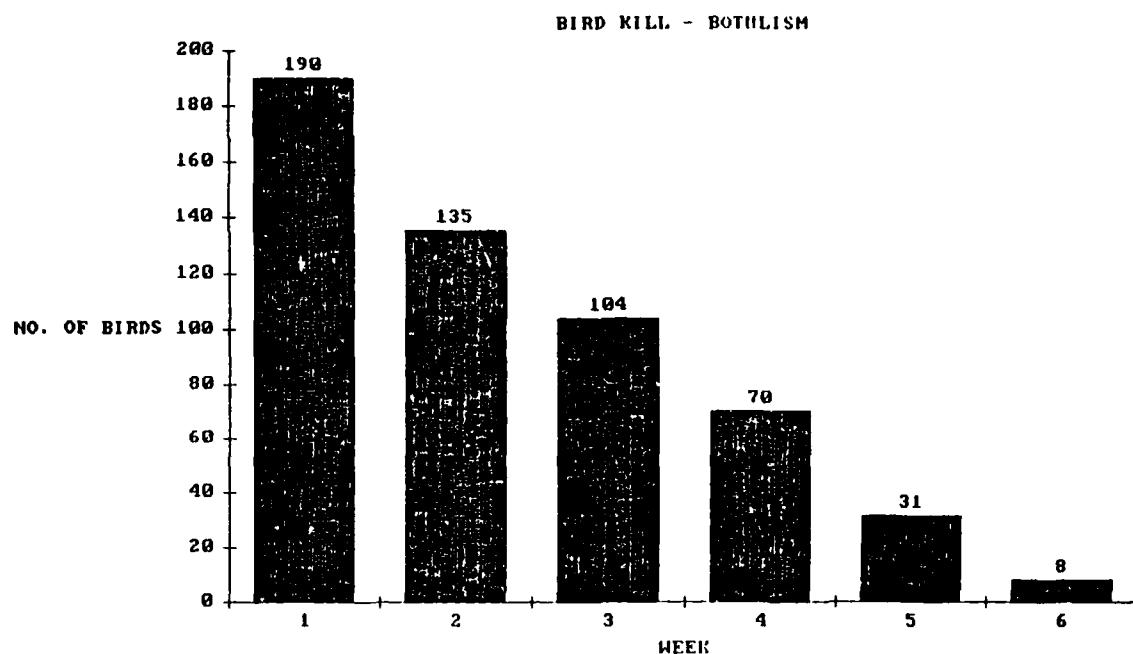


Figure A2. Deaths due to botulism, per week

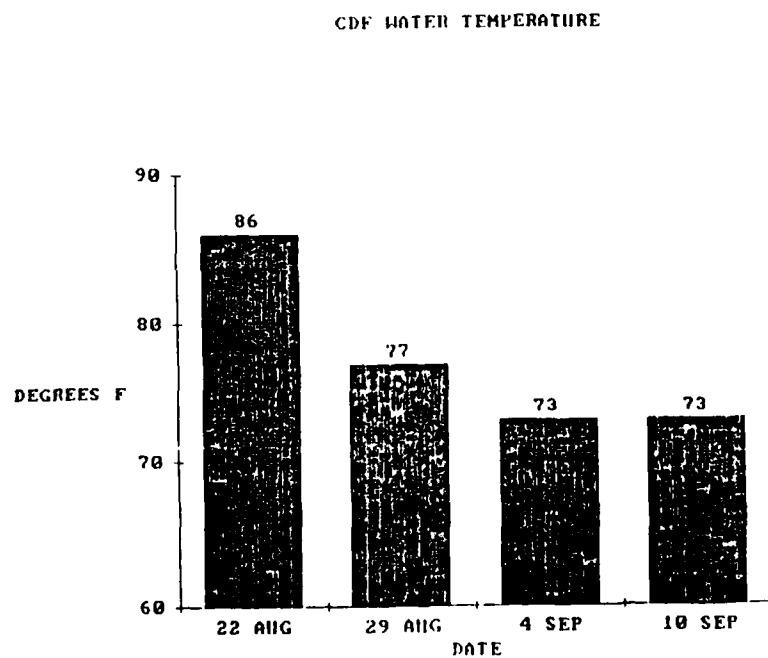


Figure A3. CDF water temperature

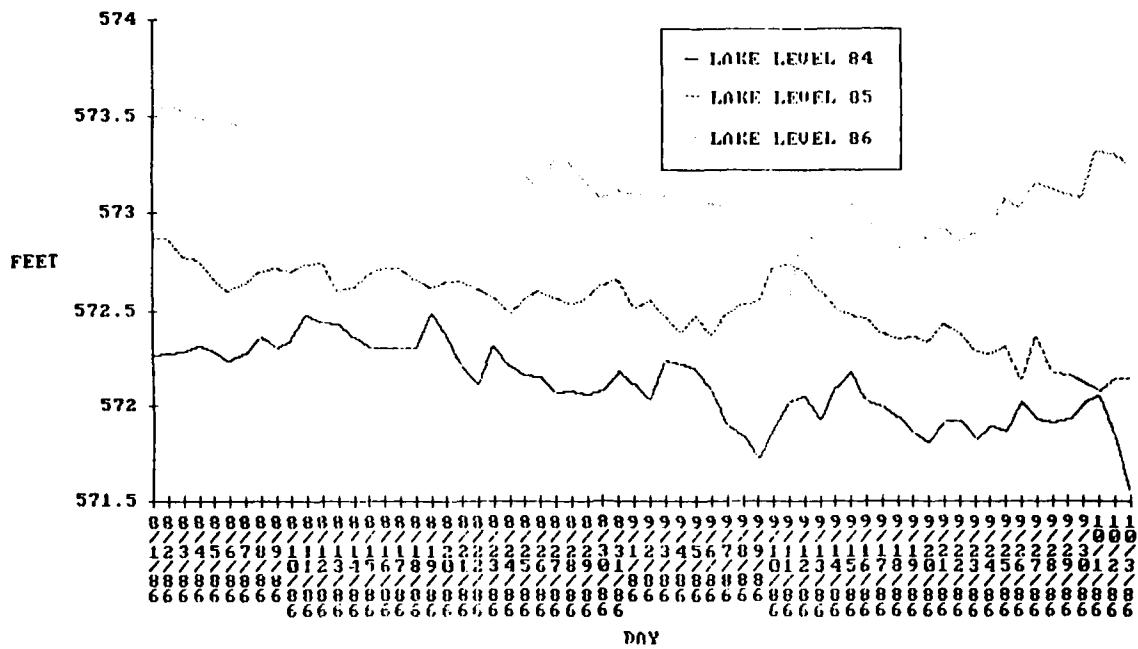


Figure A4. Water level at Dike 14 CDF

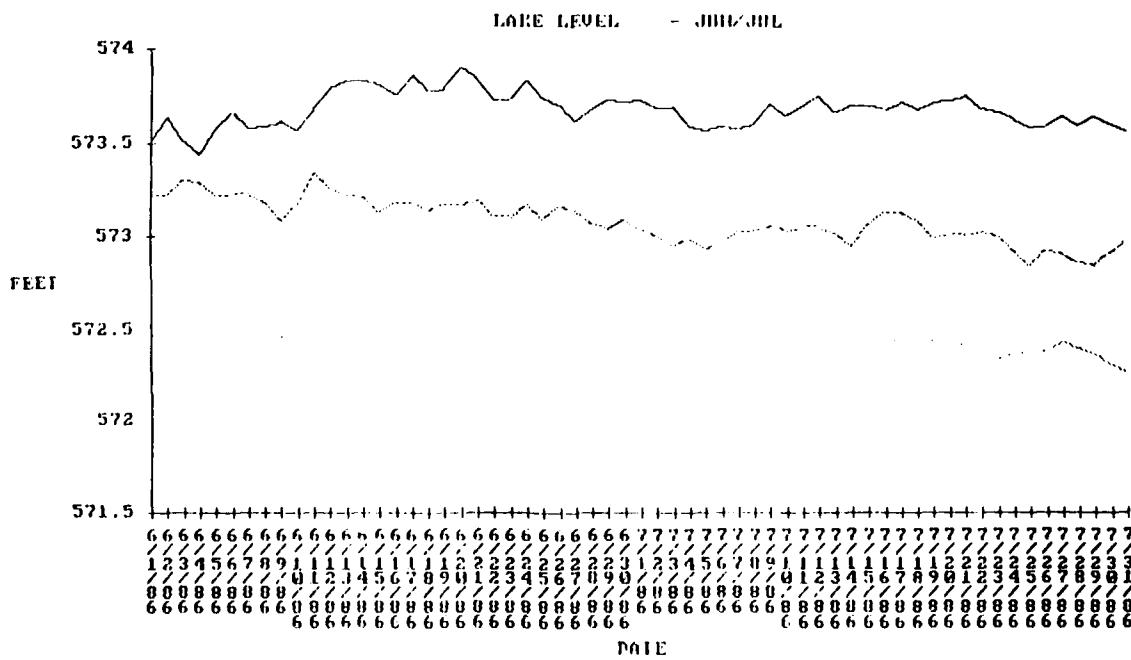


Figure A5. Water level, June and July, 1986

**APPENDIX B  
DOCUMENTATION OF THE NUMBER OF BIRDS KILLED  
AT DIKE 14**



REPLY TO  
ATTENTION OF

NCBPD-ER

24 NOV 1986

SUBJECT: Cleveland Dike 14 Botulism Problem

Mr. Kent Kroonemeyer  
Field Supervisor  
U.S. Fish and Wildlife Service  
Division of Ecological Services  
3990 East Broad Street  
Columbus, OH 43212

Dear Mr. Kroonemeyer:

I have enclosed a copy of the day-by-day summary of the number of birds collected by our contractor at the Cleveland, Ohio CDF this past summer as requested. Your continued interest and assistance is greatly appreciated.

My point of contact pertaining to this matter is Mr. William F. MacDonald of my Environmental Resources Branch, who can be contacted by calling commercial number (716)876-5454, extension 2175 or by writing to:

District Commander  
U.S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199  
ATTN: Mr. William F. MacDonald

The Buffalo District -- Leadership in Engineering.

Sincerely,

*Daniel R. Clark*  
DANIEL R. CLARK  
Colonel, Corps of Engineers  
District Commander

Enclosure  
as stated

**Dead Birds (August 24 - October 3, 1986)**

**(only pickup burn)**

<b>Date</b>	<b>Day</b>	<b>No. of birds</b>
8/24	Sun	59
8/25	Mon	51
8/26	Tue	9 by 9AM
8/27	Wed	5 ducks (2 from park) (! sent to Vet. by State)
8/28	Thu	14 by 10AM
8/29	Fri	40 birds & 2 ducks
8/30	Sat	12
8/31	Sun	8
9/1	Mon	45
9/2	Tue	17
9/3	Wed	14
9/4	Thu	0
9/5	Fri	5
9/6	Sat	46
9/7	Sun	30
9/8	Mon	27
9/9	Tue	14
9/10	Wed	10
9/11	Thu	12
9/12	Fri	4
9/13	Sat	7
9/14	Sun	12
9/15	Mon	14
9/16	Tue	7
9/17	Wed	9
9/18	Thu	11
9/19	Fri	8
9/20	Sat	9
9/21	Sun	10
9/22	Mon	6
9/23	Tue	3
9/24	Wed	3
9/25	Thu	2
9/26	Fri	4
9/27	Sat	3
9/28	Sun	2
9/29	Mon	3
9/30	Tue	2
10/1	Wed	1
10/2	Thu	0
10/3	Fri	0

**APPENDIX C  
DIAGNOSTIC SERVICES CASE REPORTS,  
NATIONAL WILDLIFE HEALTH CENTER,  
US FISH AND WILDLIFE SERVICE**

U.S. FISH AND WILDLIFE SERVICE  
NATIONAL WILDLIFE HEALTH CENTER  
6006 Schroeder Road  
Madison, Wisconsin 53711

**DIAGNOSTIC SERVICES CASE REPORT**

Case # 6546

Epizoo # 86-074

RHT: PG/JCF

Submitter:  
Ken Multerer  
Bill Curry  
FWS-RCA  
3990 E. Broad Street  
Columbus, OH 43216

Specimen description/Identification:  
Dowitchers/Sandpipers

Date Submitted: 8/19/96

Location: Corps of Engineers confined disposal facility, Cleveland, OH.

General Diagnosis: Type C Botulism

Comments: As you can see from the enclosed necropsy sheets, we were able to demonstrate Type C botulism as the cause of death of the shorebirds (NWHC: 6546-001 thru 008).

Liver samples from birds 001, 002, 005, 006 and 007 were analyzed for lead. Concentration of lead found in the livers of birds 001, 005, and 007 are within normal background range. No lead was detected in livers of birds 002 and 006.

X See attached necropsy records for individual specimen observations.  
Note: Copies of this report have been sent to:

USFWS Regional Office (RO )

Louis Lakin

Pathologist: Lou N. Locke, D.V.M.

If you have questions regarding this case, contact P. A. Gulette, D.V.M.  
at 608-271-4640 (FTS 364-5418). Include above Case Number.

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address  
 Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216

Case:	6546
Accession:	001
Collected:	8/14/86
Exam Date:	(8/20/86)
Pathologist:	LNL/NJ

Species: Short-bill dowitcher Specimen: Carcass  
 Bandtype: (D) Ref/Band No: ( ) Botl Euth: (N) Weight: (Gm) ( ) 90  
 History Summary: The submitter suspects a botulism die-off. Lagoon has shallow water - dredging materials stored in this area. There has been a history of toxic problems. Clinical signs, some green vents and limberneck observed. Mortality location: Corps of Engineer confined disposal facility near Cleveland, Ohio.

## External/Internal Observations - Laboratory Results

External: No significant findings (NSF).

Internal/Musculoskeletal system: Pectoral muscles are moderately reduced +2. There is a moderate amount of subcutaneous fat. No fractures found. There were maggots in the oral cavity around the vent.  
 Cardiovascular system: A small amount of coronary fat was present. No obvious lesions seen in the heart muscle.  
 Respiratory system: Marked postmortem changes in the lung. There is some postmortem accumulation of bloody fluid in the ventral portion of the lungs.  
 Digestive system: Liver - Early postmortem changes, no obvious lesions seen. Gall bladder - normal. There is a small amount of abdominal fat present. Esophagus and proventriculus are gross normal. Gizzard - Gizzard lining is stained dark blackish-blue due to postmortem change. No lead or steel present in the gizzard. Intestinal tract - Postmortem changes.  
 Urogenital system: Gonads are those of a non-breeding adult male. Kidneys - Early postmortem changes.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- .18 ppm wet wt; .60 ppm dry wt.

Preliminary Diagnosis: Suspect botulism  
 Sex (M) Age (A)/( ) Body Cond. (G) Postmortem State (F) Gizz. Lead ( )/( )  
 Samples Saved:  
 1. Bact: heart-bot 4. \_\_\_\_\_  
 2. Tox: liver-Pb 5. \_\_\_\_\_  
 3. \_\_\_\_\_ 6. \_\_\_\_\_

Final Diagnosis (order of importance)	Exam type (GO)				
	topog.	morph.	etiol.	funct.	diseas
1. <u>Type C botulism</u>	( )	( )	( )	( )	( )
2. _____	( )	( )	( )	( )	( )
3. _____	( )	( )	( )	( )	( )

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken Multerer  
Bill Curry  
USFWS-RCA  
3990 E. Broad Street  
Columbus, OH 43216

Case: 6546  
Accession: 002  
Collected: 8/14/86  
Exam Date: (8/20/86)  
Pathologist: LNL *SMZ*

Species: Short-bill dowitcher Specimen: Carcass  
Bandtype: E, Ref/Band No: ( Bot2 ) Euth: ( N ) Weight:(Gm) ( 110 )  
History Summary: See 001.

External/Internal Observations - Laboratory Results

External: Prominent sternal keel.

Internal/Musculoskeletal system: Pectoral muscles are markedly reduced +3. There is some subcutaneous fat still present. There are no fractures of the wing or leg bones.

Cardiovascular system: Normal - Small amount of coronary fat present.

Respiratory system: Normal

Abdominal cavity: Liver - Grossly normal. Gall bladder is enlarged and filled with greenish bile. Abdominal fat is absent. Esophagus, proventriculus are normal. Gizzard - Gizzard lining is dull tan-brown in color. No ingested lead or steel shot present. Intestinal tract - Grossly normal.

Urogenital system: Gonads are those of a non-breeding adult female. Ovary - Normal. Follicles 1 mm or less in diameter. Kidneys - Grossly normal.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- Not Detected.

Preliminary Diagnosis: Suspect botulism

Sex (F) Age (A)/( ) Body Cond. (P) Postmortem State (G) Gizz. Lead ( \_0 )/( \_0 )

Samples Saved:

- |                                  |    |
|----------------------------------|----|
| 1. Bact: heart-bot               | 4. |
| 2. Tox: liver-Pb                 | 5. |
| 3. Hist: kidney (renal coccidia) | 6. |

Final Diagnosis (order of importance)

Exam type (GO3)  
topog. morph. etiol. funct. diseas

- |                           |     |     |     |     |     |
|---------------------------|-----|-----|-----|-----|-----|
| 1. <u>Type (botulism)</u> | ( ) | ( ) | ( ) | ( ) | ( ) |
| 2. _____                  | ( ) | ( ) | ( ) | ( ) | ( ) |
| 3. _____                  | ( ) | ( ) | ( ) | ( ) | ( ) |

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address  
 Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216  
 Species: Short-bill dowitcher Specimen: Carcass  
 Bandtype: (E) Ref/Band No: ( ) Bot? Euth: (N) Weight:(Gm) ( 85 )  
 History Summary: See 001.

Case: 6546  
 Accession: 003  
 Collected: 8/14/86  
 Exam Date: (8/20/86)  
 Pathologist: LNL

**External/Internal Observations - Laboratory Results**  
**External:** There is a prominent sternal keel. This carcass shows marked postmortem changes and unsuitable for laboratory study.

**Internal:**

Carcass was discarded

Preliminary Diagnosis: Rotten. Carcass discarded  
 Sex ( ) Age ( )/( ) Body Cond. ( ) Postmortem State (P) Gizz. Lead ( )/( )  
 Samples Saved:

1. \_\_\_\_\_ 4. \_\_\_\_\_  
 2. \_\_\_\_\_ 5. \_\_\_\_\_  
 3. \_\_\_\_\_ 6. \_\_\_\_\_

Final Diagnosis (order of importance)

	topog.	morph.	Exam type (GO)	etiol.	funct.	diseas.
1. Open. Rotten. Carcass was	( )	( )	( )	( )	( )	( )
2. discarded	( )	( )	( )	( )	( )	( )
3. _____	( )	( )	( )	( )	( )	( )

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

## Submitter's Name, Affiliation Address

Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216

Case: 6546  
 Accession: 004  
 Collected: 8/14/86  
 Exam Date: (8/20/86)  
 Pathologist: LNL

Species: Semipalmated sandpiper

Specimen: Carcass

Bandtype: (E) Ref/Band No: (Bot5) Euth: (N) Weight:(Gm) (30)

LAZ

History Summary: See 001.

## External/Internal Observations - Laboratory Results

External: Sternal keel is somewhat prominent. There is staining of the vents. No fractures of the leg or wing bones seen.

## Internal:

Examination shows that postmortem changes in this Sandpiper are too advanced for subsequent laboratory study so this carcass will be discarded.

## Preliminary Diagnosis:

Rotten

Sex ( ) Age ( )/( ) Body Cond. ( ) Postmortem State (P) Gizz. Lead ( )/( )

## Samples Saved:

- |             |             |          |
|-------------|-------------|----------|
| 1. <u>R</u> | <u>None</u> | 4. _____ |
| 2. _____    | 5. _____    | 6. _____ |

## Final Diagnosis (order of importance)

	topog.	morph.	etiol.	funct.	diseas
--	--------	--------	--------	--------	--------

- |                                     |     |     |     |     |     |
|-------------------------------------|-----|-----|-----|-----|-----|
| 1. <u>Rotten. Carcass discarded</u> | ( ) | ( ) | ( ) | ( ) | ( ) |
| 2. _____                            | ( ) | ( ) | ( ) | ( ) | ( ) |
| 3. _____                            | ( ) | ( ) | ( ) | ( ) | ( ) |

NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

Submitter's Name, Affiliation Address

Ken MKulterer  
Bill Curry  
FWS-RCA  
3990 E. Broad Street  
Columbus, OH 43216

Case: 6546  
Accession: 005  
Collected: 8/14/86  
Exam Date: (8/20/86)  
Pathologist: LNL/LNL

Species: Semipalmated sandpiper Specimen: Carcass  
Bandtype: (E) Ref/Band No: (Bot3) Euth: (N) Weight:(Gm) ( )  
History Summary: See 001.

External/Internal Observations - Laboratory Results  
External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are moderately reduced +1. There is a moderate amount of subcutaneous fat and abdominal fat.

Cardiovascular system: Heart - Grossly normal.

Respiratory system: Lungs - Grossly normal.

Digestive system: Liver - Normal. Gall bladder - Normal. Intestinal tract - Grossly normal. Gizzard - Gizzard lining is normal. No ingested lead or steel shot.

No obvious lesions in the liver, lungs or kidneys.

Urogenital system: Kidneys - Lighter than normal, light purple in color.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- 0.0 ppm wet wt; 0.0 ppm dry wt.

Preliminary Diagnosis: Suspect botulism

Sex (F) Age (I)/( ) Body Cond. (G) Postmortem State (G) Giz. Lead ( )/( )

Samples Saved:

- |                    |    |
|--------------------|----|
| 1. Bact: heart-bot | 4. |
| 2. Tox: liver-Pb   | 5. |
| 3.                 | 6. |

Final Diagnosis (order of importance)

	topog.	morph.	Exam type (G03)	etiol.	funct.	disea
1. Type C Botulism.	( )	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )	( )

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

## Submitter's Name, Affiliation Address

Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216

Case: 6546  
 Accession: 006  
 Collected: 8/14/86  
 Exam Date: (8/20/86)  
 Pathologist: LNL *AK*

Species: Semipalmated sandpiper Specimen: Carcass  
 Bandtype: (E) Ref/Band No: (\_\_\_\_) Bot8 Euth: (Y) Weight:(Gm) (\_\_\_\_)

History Summary: See 001. This bird was found sick and then killed.

## External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are normal. Excellent deposits of subcutaneous fat, 1 to 2 mm thick. Good deposits of abdominal fat.  
 Cardiovascular system: Normal - Coronary fat is present on the heart.  
 Digestive system: Good deposits of abdominal fat. Liver and gall bladder - Normal. Gizzard - Normal. No ingested lead or steel shot.  
 Respiratory system: Normal.  
 Urogenital system: Ovary is that of a non-breeding adult female. Follicles are 1 mm or less in diameter. Kidneys are grossly normal.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- Not Detected.

Preliminary Diagnosis: Suspect botulism  
 Sex (F) Age (A)/(\_\_\_\_) Body Cond. (G) Postmortem State (E) Giz. Lead (\_\_\_\_)/(\_\_\_\_)

## Samples Saved:

1. Bact: heart-bot \_\_\_\_\_ 4. \_\_\_\_\_
2. Tox: liver-lead \_\_\_\_\_ 5. \_\_\_\_\_
3. \_\_\_\_\_ 6. \_\_\_\_\_

## Final Diagnosis (order of importance)

	topog.	morph.	etiol.	funct.	diseas
1. Type C. Botulism	(____)	(____)	(____)	(____)	(____)
2. _____	(____)	(____)	(____)	(____)	(____)
3. _____	(____)	(____)	(____)	(____)	(____)

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

## Submitter's Name, Affiliation Address

Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216

Case: 6546  
 Accession: 007  
 Collected: 8/14/86  
 Exam Date: (8/20/86)  
 Pathologist: LNL

Species: Least sandpiper Specimen: Carcass  
 Bandtype: (E) Ref/Band No: ( Bot4 ) Euth: ( N ) Weight:(Gm) ( 45 )  
 History Summary: See 001.

## External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: There is some subcutaneous fat present. Pectoral muscles are moderately reduced +2.

Cardiovascular system: The heart is grossly normal. There is a small amount of coronary fat present.

Respiratory system: Grossly normal

Digestive system: Grossly normal. Gizzard - Normal. No ingested steel or lead shot present.

Intestinal tract - Grossly normal.

Urogenital system: Grossly normal. Testes and kidneys - normal.

BACTERIOLOGY: Heart Pool- Clostridium botulinum C (Positive).

TOXICOLOGY: Liver Lead- 0.65 ppm wet wt; 2.25 ppm dry wt.

## Preliminary Diagnosis: Suspect botulism

Sex (M) Age (A)/( ) Body Cond. (G) Postmortem State (G) Giz. Lead ( )/( )

Samples Saved:

1. Heart 4.  
 2. \_\_\_\_\_ 5.  
 3. \_\_\_\_\_ 6.

## Final Diagnosis (order of importance)

	topog.	morph.	Exam type (G)	etiol.	funct.	disea
1. <u>Type C Botulism</u>	( )	( )	( )	( )	( )	( )
2. _____	( )	( )	( )	( )	( )	( )
3. _____	( )	( )	( )	( )	( )	( )

## NATIONAL WILDLIFE HEALTH CENTER - NECROPSY REPORT

## Submitter's Name, Affiliation Address

Ken Multerer  
 Bill Curry  
 FWS-RCA  
 3990 E. Broad Street  
 Columbus, OH 43216

Case: 6546  
 Accession: 008  
 Collected: 8/14/86  
 Exam Date: (8/20/86)  
 Pathologist: LNL

Species: Least sandpiper Specimen: Carcass  
 Bandtype: (E) Ref/Band No: ( Bot6 ) Euth: ( N ) Weight:(Gm) ( 40 )  
 History Summary: See 001.

&lt;1&lt;

## External/Internal Observations - Laboratory Results

External: No significant findings (NSF)

Internal/Musculoskeletal system: Pectoral muscles are slightly reduced. There is a moderate amount of subcutaneous and abdominal fat.

Cardiovascular system: Some coronary fat was present. Heart - Grossly normal.

Respiratory system: Lungs - Grossly normal.

Digestive system: Liver - Grossly normal. Intestinal tract - Normal. Gizzard - Normal. No ingested lead shot.

## Preliminary Diagnosis: Suspect botulism

Sex (M) Age (A)/(\_\_\_\_) Body Cond. (G) Postmortem State (G) Gizz. Lead (\_\_\_\_)/(\_\_\_\_)

## Samples Saved:

- |          |          |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

## Final Diagnosis (order of importance)

	topog.	morph.	etiol.	funct.	diseas
--	--------	--------	--------	--------	--------

- |                            |        |        |        |        |        |
|----------------------------|--------|--------|--------|--------|--------|
| 1. <u>Suspect Botulism</u> | (____) | (____) | (____) | (____) | (____) |
| 2. _____                   | (____) | (____) | (____) | (____) | (____) |
| 3. _____                   | (____) | (____) | (____) | (____) | (____) |

**APPENDIX D  
BIRD SPECIES REPORTED FROM  
THE DIKE 14 CDF BEFORE AND AFTER  
THE PILOT PROJECT**

Jan., Feb., Mar. 1986

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klammer  
Nancy R. Klammer

Field Time:

To:

From:

Total:

No reports for Jan + Feb due to  
the weather

Localities:

Species observed

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

WATER BIRDS			
	Common Loon		
	Horned Grebe		
	Pied-billed Grebe		
	Double-crested Cormorant		
HERONS			
	Great Blue Heron		
	American Egret	Common	
	Snowy Egret		
	Little Blue Heron		
	Green Heron		
	Black-crowned Night Heron		
	American Bittern		
	Least Bittern		
SWANS, GEESE, DUCKS			
	Whistling Swan		
	Canada Goose		
	Snow Goose		
	Blue Goose		
	Mallard		
	Black Duck		
	Gadwall		
	European Widgeon		
	Baldpate American Wigeon		
	Pintail		
	Green-winged Teal		
	Blue-winged Teal		
	Shoveller		
	Wood Duck		
	Redhead		
	Ring-necked Duck		
	Canvas-back		
	Greater Scaup Duck		
	Lesser Scaup Duck		
	American Golden-eye		
	Buffle-head		
	Old-squaw		
	White-winged Scoter		
	Ruddy Duck		
	Hooded Merganser		
	American Merganser		
	Red-breasted Merganser		

VULTURES, HAWKS, FALCONS			
	Turkey Vulture		
	Shari-shinned Hawk		
	Cooper's Hawk		
	Red-tailed Hawk		
	Red-shouldered Hawk		
	Broad-winged Hawk		
	Rough-legged Hawk		
	Bald Eagle	(1/4/86)	
	Marsh Hawk		
	Osprey		
	Duck Hawk		
	Pigeon Hawk		
	Sparrow Hawk <del>distrel</del>		
GALLINACEOUS BIRDS			
	Ruffed Grouse		
	Hungarian Partridge		
	Bob-white		
	Ring-necked Pheasant		
MARSH BIRDS			
	King Rail		
	Virginia Rail		
	Sora		
	Florida Gallinule		
	Coot		
SHOREBIRDS			
	Piping Plover		
	Semipalmated Plover		
	Killdeer		
	Golden Plover		
	Black-bellied Plover		
	Ruddy Turnstone		
	Woodcock		
	Wilson's Snipe		
	Hudsonian Curlew		
	Upland Plover		
	Spotted Sandpiper		
	Solitary Sandpiper		
	Willow		
	Greater Yellowlegs		
	Lesser Yellowlegs		
	Knot		
	Pectoral Sandpiper		
	White-rumped Sandpiper		
	Baird's Sandpiper		
	Liman Sandpiper		
	Red-backed Sandpiper		
	Dowitcher		

GULLS AND TERNS			
	Glaucous Gull		
	Great Black-backed Gull		
	Herring Gull		
	Ring-billed Gull		
	Franklin's Gull		
	Bonaparte's Gull		
DOVES AND PIGEONS			
	Forster's Tern		
	Common Tern		
	Caspian Tern		
	Black Tern		
CUCKOOS			
	Rock Dove		
	Mourning Dove		
OWLS			
	Yellow-billed Cuckoo		
	Black-billed Cuckoo		
OWLS			
	Barn Owl		
	Screech Owl		
	Great Horned Owl		
	Snowy Owl		
	Barred Owl		
	Long-eared Owl		
	Short-eared Owl		
	Saw-whet Owl		
GOATSUCKERS, ETC.			
	Whip-poor-will		
	Nighthawk		
	Chimney Swift		
Ruby-throated Hummingbird			
	Belted Kingfisher		
WOODPECKERS			
	Flicker		
	Red-bellied Woodpecker		
	Red-headed Woodpecker		
	Yellow-bellied Sapsucker		
	Hairy Woodpecker		
	Downy Woodpecker		

<b>FLYCATCHERS</b>			<b>GNATCATCHERS, ETC.</b>			<b>WEAVER BIRDS</b>		
			Blue-gray Gnatcatcher			English Sparrow		
<i>Eastern Kingbird</i>			<i>Golden-crowned Kinglet</i>					
			<i>Ruby-crowned Kinglet</i>					
<i>Crested Flycatcher</i>			<i>American Pipit</i>					
			<i>Cedar Waxwing</i>					
<i>Phoebe</i>			<i>Northern Shrike</i>					
			<i>Migrant Shrike</i>					
<i>Yellow-bellied Flycatcher</i>			<i>Starling</i>					
<b>LARKS</b>			<b>VIREOS</b>			<b>BLACKBIRDS AND ORIOLES</b>		
			White-eyed Vireo			Bobolink		
<i>Horned Lark</i>			Yellow-throated Vireo			Meadowlark		
			Blue-headed Vireo			Western Meadowlark		
<b>SWALLOWS</b>			Red-eyed Vireo			Red-wing Blackbird		
			Philadelphia Vireo			Orchard Oriole		
<i>Tee-tail</i>			Warbling Vireo			Baltimore Oriole		
						Rusty Blackbird		
<i>Bank Swallow</i>						Brewer's Blackbird		
						Bronzed Grackle	<i>Glossy Ibis</i>	
<i>Rough-winged Swallow</i>						Cowbird		
<b>Barn Swallow</b>			<b>TANAGERS</b>					
						Scarlet Tanager		
<i>Cliff Swallow</i>			<b>FINCHES, SPARROWS, etc.</b>					
						Cardinal		
<i>Purple Martin</i>						Rose-breasted Grosbeak		
						Indigo Bunting		
<b>CROWS AND JAYS</b>						Dickcissel		
						Evening Grosbeak		
<i>Blue Jay</i>						Purple Finch		
						Pine Grosbeak		
<i>Crow</i>						Redpoll		
						Pine Siskin		
<b>TITMICE, NUTHATCHES, CREEPERS</b>						Goldfinch		
						Red Crossbill		
<i>Black-capped Chickadee</i>						White-winged Crossbill		
						Red-eyed Towhee		
<i>Tufted Titmouse</i>						Savannah Sparrow		
						Grasshopper Sparrow		
<i>White-breasted Nuthatch</i>						Henslow's Sparrow		
						Sharp-tailed Sparrow		
<i>Red-breasted Nuthatch</i>						Vesper Sparrow		
						Lark Sparrow		
<i>Brown Creeper</i>						State-colored Junco		
						Tree Sparrow		
<b>WRENS</b>						Chipping Sparrow		
						Field Sparrow		
<i>House Wren</i>						White-crowned Sparrow		
						White-throated Sparrow		
<i>Winter Wren</i>						Fox Sparrow		
						Lincoln's Sparrow		
<i>Bewick's Wren</i>						Swamp Sparrow		
						Song Sparrow		
<i>Carolina Wren</i>						Lapland Longspur		
						Snow Bunting		
<i>Lone-billed Marsh Wren</i>						<i>House Finch</i>		
<b>MOCKINGBIRDS</b>								
<i>Mockingbird</i>								
<i>Cathird</i>								
<i>Brown Thrasher</i>								
<b>THRUSHES</b>								
<i>Robin</i>								
<i>Worm Thrush</i>								
<i>Hermit Thrush</i>								
<i>Olive-backed Thrush</i>								
<i>Gray-cheeked Thrush</i>								
<i>Very</i>								
<i>Bluebird</i>								

## FIELD NOTES

Total Species:

Individuals:

Apr May, June 1986

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klammer  
Nancy R. Klammer

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

WATER BIRDS		
•	Common Loon	
•	Horned Grebe	
•	Pied-billed Grebe	
•	Double-crested Cormorant	
•	Tricolored Heron	
•	HERONS	
•	Great Blue Heron	
•	American Egret	
•	Snowy Egret	
•	Little Blue Heron	
•	Green Heron	
•	Black-crowned Night Heron	
•	American Bittern	
•	Least Bittern	
SWANS, GEESE, DUCKS		
•	Whooping Swan	
•	Canada Goose	
•	Snow Goose	
•	Blue Goose	
•	Mallard	
•	Black Duck	
•	Gadwall	
•	European Widgeon	
•	Baldpate <i>American Wigeon</i>	
•	Pintail	
•	Green-winged Teal	
•	Blue-winged Teal	
•	Shoveler	
•	Wood Duck	
•	Redhead	
•	Ring-necked Duck	
•	Canvas-back	
•	Greater Scaup Duck	
•	Lesser Scaup Duck	
•	American Golden-eye	
•	Buffle-head	
•	Old-squaw	
•	White-winged Scoter	
•	Ruddy Duck	
•	Hooded Merganser	
•	American Merganser	
•	Red-breasted Merganser	

VULTURES, HAWKS, FALCONS		
	Turkey Vulture	
	Sharp-shinned Hawk	
	Cooper's Hawk	
•	Red-tailed Hawk	
	Red-shouldered Hawk	
	Broad-winged Hawk	
	Rough-legged Hawk	
	Bald Eagle	
	Marsh Hawk	
	Osprey	
	Duck Hawk	
	Pigeon Hawk	
	Sparrow Hawk <i>Kestrel</i>	
GALLINACEOUS BIRDS		
	Ruffed Grouse	
	Hungarian Partridge	
	Bob-white	
	Ring-necked Pheasant	
MARSH BIRDS		
	King Rail	
	Virginia Rail	
	Sora	
	Fairbank's Gallinule	
	Common Moorhen	
	Coot	
SHOREBIRDS		
	Piping Plover	
	Semipalmated Plover	
	Killdeer	
	Golden Plover	
	Black-bellied Plover	
	Ruddy Turnstone	
	Woodcock	
	Wilson's Snipe <i>Common</i>	
	Hudsonian Curlew	
	Upland Plover	
	Spotted Sandpiper	
	Solitary Sandpiper	
	Willet	
	Greater Yellowlegs	
	Lesser Yellowlegs	
	Knot	
	Fectoral Sandpiper	
	White-rumped Sandpiper	
	Baird's Sandpiper	
	Least Sandpiper	
	Red-backed Sandpiper <i>Dunlin</i>	
	Dowitcher	

SILT SANDPIPER		
	Semipalmated Sandpiper	
	Western Sandpiper	
	Buff-breasted Sandpiper	
	Sanderling	
RED PHALAROPE		
	Wilson's Phalarope	
	Northern Phalarope	
GULLS AND TERNS		
	<i>Charm</i> Gull <i>Glaucous</i>	
	Great Black-backed Gull	
	Herring Gull	
	Ring-billed Gull	
	Franklin's Gull	
	Bonaparte's Gull	
FORSTER'S TERN		
	Forster's Tern	
COMMON TERN		
	Common Tern	
CASPIAN TERN		
	Caspian Tern	
BLACK TERN		
	Black Tern	
DOVES AND PIGEONS		
	Rock Dove	
	Mourning Dove	
CUCKOOS		
	Yellow-billed Cuckoo	
	Black-billed Cuckoo	
OWLS		
	Barn Owl	
	Screech Owl	
	Great Horned Owl	
	Snowy Owl	
	Barn Owl	
	Long-eared Owl	
	Short-eared Owl	
	Saw-whet Owl	
GOATSUCKERS, ETC.		
	Whip-poor-will	
	Nighthawk	
CHIMNEY SWIFT		
	Chimney Swift	
RUBY-THROATED HUMMINGBIRD		
	Ruby-throated Hummingbird	
BELTED KINGFISHER		
	Belted Kingfisher	
WOODPECKERS		
	Flicker	
	Red-bellied Woodpecker	
	Red-headed Woodpecker	
	Yellow-bellied Sapsucker	
	Hairy Woodpecker	
	Downy Woodpecker	

FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadian Flycatcher
		<del>Blue Flycatcher</del>
		Least Flycatcher
		Wood Pewee
		Olivaceous Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Bewick's Wren
		Carolina Wren
		Long-billed Marsh Wren
		Short-billed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Gulfbird
		Brown Thrasher
THRUSHES		
		Robin
		Wood Thrush
		Brent Thrush
		<del>Oreococcyx Thrush</del>
		Gray-cheeked Thrush
		Vireo
		Bluethroat

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
		American Pipit
		Cedar Waxwing
		Northern Shrike
		Migrant Shrike
		Starling
VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo
WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blue-winged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Pauline Warbler
		Yellow Warbler
		Magnolia Warbler
		Cape May Warbler
		Black-throated Blue Warbler
		Myrtle Warbler
		Black-throated Green Warbler
		Cerulean Warbler
		Blackburnian Warbler
		Chestnut-sided Warbler
		Red-breasted Warbler
		Hark-tail Warbler
		Pine Warbler
		Prairie Warbler
		Palm Warbler
		Ovenbird
		Northern Water-thrush
		Louisiana Water-thrush
		Kentucky Warbler
		Connecticut Warbler
		Mourning Warbler
		Yellowthroat
		Yellow-breasted Chat
		Hooded Warbler
		Wilson's Warbler
		Canada Warbler
		Redstart
WEAVER BIRDS		
		English Sparrow
BLACKBIRDS AND ORIOLES		
		Bobolink
		Meadowlark
		Western Meadowlark
		Red-wing Blackbird
		Orchard Oriole
		<del>Red-headed Oriole</del>
		Rusty Blackbird
		Brewer's Blackbird
		<del>Brewer's Grackle</del>
		Cowbird
TANAGERS		
		Scarlet Tanager
FINCHES, SPARROWS, etc.		
		Cardinal
		Rose-breasted Grosbeak
		Indigo Bunting
		Dickcissel
		Evening Grosbeak
		Purple Finch
		Pine Grosbeak
		Redpoll
		Pine Siskin
		Goldfinch
		Red Crossbill
		White-winged Crossbill
		<del>Red-headed Towhee</del>
		<del>Augoue</del>
		Savannah Sparrow
		Grasshopper Sparrow
		Bonaparte's Sparrow
		Sharptailed Sparrow
		Vesper Sparrow
		Lark Sparrow
		State-colored Junco
		Tree Sparrow
		Chipping Sparrow
		Field Sparrow
		White-crowned Sparrow
		White-throated Sparrow
		Fox Sparrow
		<del>Lincoln's Sparrow</del>
		Swamp Sparrow
		Song Sparrow
		Lineland Towhee
		<del>Snow Bunting</del>
		<del>House Finch</del>

## FIELD NOTES

Total Species:

Individuals:

July, Aug, Sept 1916

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klamann  
Nancy R. Klamann

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>GULLS AND TERNS</b>
Common Loon	Turkey Vulture	Stilt Sandpiper
Horned Grebe	Sharp-shinned Hawk	Semipalmated Sandpiper
Pied-billed Grebe	Coooper's Hawk	Western Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Buff-breasted Sandpiper
	Red-shouldered Hawk	Sanderling
	Broad-winged Hawk	
	Rough-legged Hawk	
	Bald Eagle	
	Marsh Hawk	
	Osprey	
	Duck Hawk Fire-tail	
	Pigeon Hawk	
	Sparrow Hawk Crested	
<b>HERONS</b>	<b>GALLINACEOUS BIRDS</b>	<b>DOVES AND PIGEONS</b>
Great Blue Heron	Ruffed Grouse	Rock Dove
American Egret	Hungarian Partridge	Mourning Dove
Snowy Egret	Bob-white	
Little Blue Heron	Ring-necked Pheasant	
Green Heron		
Black-crowned Night Heron		
American Bittern	<b>MARSH BIRDS</b>	
Least Bittern	King Rail	
	Virginia Rail	
<b>SWANS, GEESES, DUCKS</b>	Sora	
Whooping Swan	Florida Gallinule Common Moorhen	
Canada Goose	Coot	
Snow Goose		
Blue Goose		
Mallard	<b>SHOREBIRDS</b>	
Black Duck	Piping Plover	
Gadwall	Semipalmated Plover	
European Widgeon	Killdeer	
<del>Belding's Merganser</del>	Golden Plover	
Pintail	Black-bellied Plover	
Green-winged Teal	Ruddy Turnstone	
Blue-winged Teal	Woodcock	
Shoveler	Wilson's Snipe	
Wood Duck	Hudsonian Curlew	
	Upland Plover	
Redhead	Spotted Sandpiper	
Ring-necked Duck	Solitary Sandpiper	
Canvas-back	Willie	
Greater Scaup Duck	Greater Yellowlegs	
Lesser Scaup Duck	Lesser Yellowlegs	
American Golden-eye	Knot	
Buff-head	Pectoral Sandpiper	
Old-squaw	White-rumped Sandpiper	
White-winged Scoter	Baird's Sandpiper	
Ruddy Duck	Least Sandpiper	
Hooded Merganser	Red-backed Sandpiper	
American Merganser	Dowitcher	
Red-breasted Merganser	<i>American Avocet</i>	
	<i>Marsup. Godwit</i>	

FLYCATCHERS		
	Eastern Kingbird	
	Crested Flycatcher	
	Phoebe	
	Yellow-bellied Flycatcher	
	Acorn Flycatcher	
	<i>Amber Flycatcher</i> <i>Indigo</i>	
	Least Flycatcher	
	Wood Pewee	
	Olive-sided Flycatcher	
	Empidonax	
LARKS		
	Horned Lark	
SWALLOWS		
	Tree Swallow	
	Barn Swallow	
	Rough-winged Swallow	
	Barn Swallow	
	Cliff Swallow	
	Purple Martin	
CROWS AND JAYS		
	Blue Jay	
	Crow	
TITMICE, NUTHATCHES, CREEPERS		
	Black-capped Chickadee	
	Tufted Titmouse	
	White-breasted Nuthatch	
	Red-breasted Nuthatch	
	Brown Creeper	
WRENS		
	House Wren	
	Winter Wren	
	Bewick's Wren	
	Carolina Wren	
	Lone-billed Marsh Wren	
	Short-billed Marsh Wren	<i>Sedge</i>
MOCKINGBIRDS		
	Mockingbird	
	Catherd	
	Brown Thrasher	
THRUSHES		
	Robin	
	Wood Thrush	
	Hermit Thrush	
	<i>Ornamented Thrush</i> <i>Swainsoni</i>	
	Gray-cheeked Thrush	
	Vireo	
	Blindbird	

GNATCATCHERS, ETC.		
	Blue-gray Gnatcatcher	
	Golden-crowned Kinglet	
	Ruby-crowned Kinglet	
	American Pipit	
	Cedar Waxwing	
	Northern Shrike	
	Mourning Shrike	
	Starling	
VIREOS		
	White-eyed Vireo	
	Yellow-throated Vireo	
	Blue-headed Vireo	
	Red-eyed Vireo	
	Philadelphia Vireo	
	Warbling Vireo	
WOOD WARBLERS		
	Black and White Warbler	
	Prothonotary Warbler	
	Golden-winged Warbler	
	Blue-winged Warbler	
	Tennessee Warbler	
	Orange-crowned Warbler	
	Nashville Warbler	
	Parula Warbler	
	Yellow Warbler	
	Magnolia Warbler	
	Cape May Warbler	
	Black-throated Blue Warbler	
	<i>Yellow-rumped Warbler</i> <i>vermiculata</i>	
	Black-throated Green Warbler	
	Geulden Warbler	
	Blackburnian Warbler	
	Chestnut-sided Warbler	
	Bay-breasted Warbler	
	Blackpoll Warbler	
	Pine Warbler	
	Prairie Warbler	
	Palm Warbler	
	Ovenbird	
	Northern Water-thrush	
	Louisiana Water-thrush	
	Kentucky Warbler	
	Connecticut Warbler	
	Mourning Warbler	
	Yellow-throat	
	Yellow-breasted Chat	
	Hooded Warbler	
	Wilson's Warbler	
	Canada Warbler	
	Restart	

WEAVER BIRDS		
	English Sparrow	

BLACKBIRDS AND ORIOLES		
	Bobolink	
	Meadowlark	
	Western Meadowlark	
	Red-wine Blackbird	
	Orchard Oriole	
	Baltimore Oriole	
	Rusty Blackbird	
	Brewer's Blackbird	
	Brained Grackle <i>J. dominica</i>	
	Cowbird	

TANAGERS		
	Scarlet Tanager	

FINCHES, SPARROWS, etc.

	Cardinal	
	Rose-breasted Grosbeak	
	Indigo Bunting	
	Dickensel	
	Evening Grosbeak	
	Purple Finch	
	Pine Grosbeak	
	Redpoll	
	Pine Siskin	
	Goldfinch	
	Red Crossbill	
	White-winned Crossbill	
	Red-eyed Towhee	
	Savannah Sparrow	
	Grasshopper Sparrow	
	Henslow's Sparrow	
	Sharp-tailed Sparrow	
	Vesper Sparrow	
	Lark Sparrow	
	Slater-colored Junco	
	Tree Sparrow	
	Chipping Sparrow	
	Feld Sparrow	
	White-crowned Sparrow	
	White-throated Sparrow	
	Fox Sparrow	
	Lincoln's Sparrow	
	Scamp Sparrow	
	Song Sparrow	
	Field Lonesome	
	Snow Bunting	
	<i>Tree Finch</i>	

FIELD NOTES

Total Species:

Individuals:

3ch. Nov., 1986

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klamann  
Nancy R. Klamann

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>GULLS AND TERNS</b>
Common Loon	Turkey Vulture	Slat Sandpiper
Horned Grebe	Sharp-shinned Hawk	Semipalmated Sandpiper
Pied-billed Grebe	Copper's Hawk	Western Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Ruff-breasted Sandpiper
	Red-shouldered Hawk	Sanderling
	Broad-winged Hawk	
	Rough-legged Hawk	
	Bald Eagle	Red Phalarope
		Wilson's Phalarope
	Marsh Hawk	Northern Phalarope
	Osprey	
	Bush-tailed Flycatcher	
	Pigeon Hawk	
	Sparrow Hawk Kestrel	
<b>HERONS</b>	<b>GALLINACEOUS BIRDS</b>	<b>DOVES AND PIGEONS</b>
Great Blue Heron	Ruffed Grouse	Glaucous Gull
American Egret	Hungarian Partridge	Great Black-backed Gull
Snowy Egret	Bob-white	Herring Gull
Little Blue Heron	Ring-necked Pheasant	Ring-billed Gull
Green Heron		Franklin's Gull
Black-crowned Night Heron		Bonaparte's Gull
<del>Cattle Egret</del>		
American Bittern		Forster's Tern
Least Bittern		Common Tern
		Caspian Tern
		Black Tern
<b>SWANS, GESE, DUCKS</b>	<b>MARSH BIRDS</b>	<b>OWLS</b>
Whistling Swan	King Rail	Barn Owl
	Virginia Rail	Screech Owl
Canada Goose	Sora	Great Horned Owl
Snow Goose	Clapper Rail	Snowy Owl
Blue Goose	Coot	Barred Owl
		Long-eared Owl
Mallard	SHOREBIRDS	Short-eared Owl
Black Duck	Piping Plover	Saw-whet Owl
Gadwall	Semipalmated Plover	
European Widgeon	Killdeer	
<del>Bluewinged American Widgeon</del>	Golden Plover	
Pintail	Black-bellied Plover	
Green-winged Teal	Ruddy Turnstone	
Blue-winged Teal		
Shoveler	Woodcock	
Wood Duck	Wilson's Snipe	
	Hudsonian Curlew	
Redhead	Upland Plover	
Ring-necked Duck	Spotted Sandpiper	
Canvas-back	Solitary Sandpiper	
Greater Scaup Duck	Willie	
Lesser Scaup Duck	Greater Yellowlegs	
American Golden-eye	Lesser Yellowlegs	
Buffle-head	Knot	
Old-squaw	Fectoral Sandpiper	
White-winged Scoter	White-rumped Sandpiper	
Ruddy Duck	Baird's Sandpiper	
	Least Sandpiper	
Hooded Merganser	Red-backed Sandpiper Dunlin	
American Merganser	Dowitcher	
Red-breasted Merganser	<i>Hudsonian Godwit</i>	
Surf Scoter		
Black Scoter		

FLYCATCHERS		
•	Eastern Kingbird	
•	Crested Flycatcher	
•	Phoebe	
•	Yellow-bellied Flycatcher	
•	Acadian Flycatcher	
•	Alder Flycatcher	
•	Least Flycatcher	
•	Wood Pewee	
•	Olive-sided Flycatcher	
•	Empidonax	
LARKS		
•	Horned Lark	
SWALLOWS		
•	Tree Swallow	
•	Bank Swallow	
•	Rough-winged Swallow	
•	Barn Swallow	
•	Cliff Swallow	
•	Purple Martin	
CROWS AND JAYS		
•	Blue Jay	
•	Crow	
TITMICE, NUTHATCHES, CREEPERS		
•	Black-capped Chickadee	
•	Tufted Titmouse	
•	White-breasted Nuthatch	
•	Red-breasted Nuthatch	
•	Brown Creeper	
WRENS		
•	House Wren	
•	Winter Wren	
•	Bewick's Wren	
•	Carolina Wren	
•	Long-billed Marsh Wren	
•	Short-billed Marsh Wren	
MOCKINGBIRDS		
•	Mockingbird	
•	Catbird	
•	Brown Thrasher	
THRUSHES		
•	Robin	
•	Wood Thrush	
•	Hermit Thrush	
•	Olive-backed Thrush	
•	Gray-cheeked Thrush	
•	Vireo	
•	Bluebird	

GNATCATCHERS, ETC.		
•	Blue-gray Gnatcatcher	
•	Golden-crowned Kinglet	
•	Ruby-crowned Kinglet	
•	American Pipit <i>N.L.</i>	
•	Cedar Waxwing	
•	Northern Shrike	
•	Murant Shrike	
•	Starling	
VIREOS		
•	White-eyed Vireo	
•	Yellow-throated Vireo	
•	Blue-headed Vireo	
•	Red-eyed Vireo	
•	Philadelphia Vireo	
•	Warbling Vireo	
WOOD WARBLERS		
•	Black and White Warbler	
•	Prothonotary Warbler	
•	Golden-winged Warbler	
•	Blue-winged Warbler	
•	Tennessee Warbler	
•	Orange-crowned Warbler	
•	Nashville Warbler	
•	Parula Warbler	
•	Yellow Warbler	
•	Magnolia Warbler	
•	Cape May Warbler	
•	Black-throated Blue Warbler	
•	Myrtle Warbler <i>Yellow - breast</i>	
•	Black-throated Green Warbler	
•	Cerulean Warbler	
•	Blackburnian Warbler	
•	Chestnut-sided Warbler	
•	Bay-breasted Warbler	
•	Blackpoll Warbler	
•	Pine Warbler	
•	Prairie Warbler	
•	Palm Warbler	
•	Ovenbird	
•	Northern Water-thrush	
•	Louisiana Water-thrush	
•	Kentucky Warbler	
•	Connecticut Warbler	
•	Mourning Warbler	
•	Yellow-throat	
•	Yellow-breasted Chat	
•	Hosted Warbler	
•	Wilson's Warbler	
•	Canada Warbler	
•	Restart	
WEAVER BIRDS		
•	English Sparrow	
BLACKBIRDS AND ORIOLES		
•	Bobolink	
•	Meadowlark	
•	Western Meadowlark	
•	Red-wink Blackbird	
•	Orchard Oriole	
•	Baltimore Oriole	
•	Rusty Blackbird	
•	Brewer's Blackbird	
•	<del>Leonard</del> Grackle <i>Jaymey</i>	
•	Cowbird	
TANAGERS		
•	Scarlet Tanager	
FINCHES, SPARROWS, etc.		
•	Cardinal	
•	Rose-breasted Grosbeak	
•	Indigo Bunting	
•	Dickcissel	
•	Evening Grosbeak	
•	Purple Finch	
•	Pine Grosbeak	
•	Redpoll	
•	Pine Siskin	
•	Goldfinch	
•	Red Crossbill	
•	White-winged Crossbill	
•	<del>Red</del> Towhee <i>Angioea - mela</i>	
•	Savannah Sparrow	
•	Grasshopper Sparrow	
•	Henslow's Sparrow	
•	Sharpe-tailed Sparrow	
•	Vesper Sparrow	
•	Lark Sparrow	
•	Slate-colored Junco	
•	Tree Sparrow	
•	Chipping Sparrow	
•	Field Sparrow	
•	White-crowned Sparrow	
•	White-throated Sparrow	
•	Fox Sparrow	
•	Lincoln's Sparrow	
•	Swamp Sparrow	
•	Song Sparrow	
•	Lapland Longspur	
•	Snow Bunting	
•	<i>cause</i> Finch	
•	<i>Le Conte's Sparrow</i>	

## FIELD NOTES

Total Species:

Individuals:

Jan., Feb., Mar. 1987

## FIELD TRIP RECORD

## **Weather:**

## Meteorological Report

### **Observers:**

William A. Klamm  
Nancy R. Klamm

**Field Time:**

To:  
From:  
Total:

#### **Localities:**

### **Distance: By Car – On Foot**

## Finish:

Start:

Total:

**Day & Date:**

<b>WATER BIRDS</b>	
Common Loon	
Horned Grebe	
Pied-billed Grebe	
Double-crested Cormorant	
<b>HERONS</b>	
Great Blue Heron	
American Egret	
Snowy Egret	
Little Blue Heron	
Green Heron	
Black-crowned Night Heron	
American Bittern	
Least Bittern	
<b>SWANS, GEESE, DUCKS</b>	
Whistling Swan	
Canada Goose	
Snow Goose	
Blue Goose	
Mallard	
Black Duck	
Gadwall	
European Widgeon	
Baldpate <del>Widgeon</del> Widgeon	
Pintail	
Green-winged Teal	
Blue-winged Teal	
Shoveller	
Wood Duck	
Redhead	
Ring-necked Duck	
Canvas-back	
Greater Scaup Duck	
Lesser Scaup Duck	
American Golden-eye	
Buffle-head	
Old-squaw	
White-winged Scoter	
Ruddy Duck	
Hooded Merganser	
American Merganser	
Red-breasted Merganser	
<b>VULTURES, HAWKS, FALCONS</b>	
Turkey Vulture or <i>fright</i>	
Sharp-shinned Hawk	
Cooper's Hawk	
Red-tailed Hawk	
Red-shouldered Hawk	
Broad-winged Hawk	
Rough-legged Hawk	
Bald Eagle	
Marsh Hawk	
Osprey	
Duck Hawk	
Pigeon Hawk	
Sparrow Hawk <i>Master</i>	
<b>GALLINACEOUS BIRDS</b>	
Ruffed Grouse	
Hungarian Partridge	
Bob-white	
Ring-necked Pheasant	
<b>MARSH BIRDS</b>	
King Rail	
Virginia Rail	
Sora	
Florida Gallinule	
Coot	
<b>SHOREBIRDS</b>	
Piping Plover	
Semipalmated Plover	
Killdeer	
Golden Plover	
Black-bellied Plover	
Ruddy Turnstone	
Woodcock	
Wilson's Snipe	
Hudsonian Curlew	
Upland Plover	
Spotted Sandpiper	
Solitary Sandpiper	
Willet	
Greater Yellowlegs	
Lesser Yellowlegs	
Knot	
Pectoral Sandpiper	
White-rumped Sandpiper	
Baird's Sandpiper	
Least Sandpiper	
Red-backed Sandpiper	
Downy-shore	
<b>GULLS AND TERNS</b>	
Glaucous Gull	
Great Black-backed Gull	
Herring Gull	
Ring-billed Gull	
Franklin's Gull	
Bonaparte's Gull	
Forster's Tern	
Common Tern	
Caspian Tern	
Black Tern	
<b>DOVES AND PIGEONS</b>	
Rock Dove	
Mourning Dove	
<b>CUCKOOS</b>	
Yellow-billed Cuckoo	
Black-billed Cuckoo	
<b>OWLS</b>	
Barn Owl	
Screech Owl	
Great Horned Owl	
Snowy Owl	
Barred Owl	
Long-eared Owl	
Short-eared Owl	
Saw-whet Owl	
<b>GOATSUCKERS, ETC.</b>	
Whip-poor-will	
Nighthawk	
Chimney Swift	
Ruby-throated Hummingbird	
Belted Kingfisher	
<b>WOODPECKERS</b>	
Flicker	
Red-bellied Woodpecker	
Red-headed Woodpecker	
Yellow-bellied Sapsucker	
Hairy Woodpecker	
Downy Woodpecker	

FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadia Flycatcher
		Alder Flycatcher
		Least Flycatcher
		Wood Pewee
		Olive-sided Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Bewick's Wren
		Carolina Wren
		Long-billed Marsh Wren
		Short-billed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Gnatcatcher
		Brown Thrasher
THRUSHES		
		Robin
		Wood Thrush
		Horned Thrush
		Olive-backed Thrush
		Crucifix-throated Thrush
		Vireo
		Bluetbird

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
American Pipit		
Cedar Waxwing		
Northern Shrike		
Migrant Shrike		
Starling		

VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo

WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blue-winged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Parula Warbler
		Yellow Warbler
		Magnolia Warbler
		Cape May Warbler
		Black-throated Blue Warbler
		Myrtle Warbler
		Black-throated Green Warbler
		Carolina Warbler
		Blakburnian Warbler
		Chestnut-sided Warbler
		Bay-breasted Warbler
		Black-and-white Warbler
		Pine Warbler
		Prairie Warbler
		Palm Warbler
		Over-snow Warbler
		Southern Water Thrush
		Louisiana Water Thrush
		Kentucky Warbler
		Connecticut Warbler
		Mountain Warbler
		Yellow Throat
		Yellow-breasted Chat
		Hooded Warbler
		Wilson's Warbler
		Canada Warbler
		Restart

WEAVER BIRDS		
		English Sparrow
BLACKBIRDS AND ORIOLES		
		Bobolink
		Meadowlark
		Western Meadowlark
		Red-wing Blackbird
		Orchard Oriole
		Baltimore Oriole
		Rusty Blackbird
		Brewer's Blackbird
		Bronzed Grackle
		Cowbird

TANAGERS		
		Scarlet Tanager
FINCHES, SPARROWS, etc.		
		Cardinal
		Rose-breasted Grosbeak
		Indigo Bunting
		Dickcissel
		Evening Grosbeak
		Purple Finch
		Pine Grosbeak
		Redpoll
		Pine Siskin
		Goldfinch
		Red Crossbill
		White-winged Crossbill
		Red-eyed Towhee
		Savannah Sparrow
		Grasshopper Sparrow
		Henslow's Sparrow
		Sharptailed Sparrow
		Vesper Sparrow
		Lark Sparrow
		State-colored Junco
		Lee Sparrow
		Linnet Sparrow
		Field Sparrow
		White-crowned Sparrow
		White-throated Sparrow
		Tax Sparrow
		Louisiana Sparrow
		Swamp Sparrow
		Song Sparrow
		Lincoln's Sparrow
		Linnet Longspur
		now Bunting
		<del>Desert LARK</del>

## FIELD NOTES

Total Species:

Individuals:

Apr, May, June 1987

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klamm  
Nancy R. Klamm

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

WATER BIRDS	
•	Common Loon
•	Horned Grebe
•	Pied-billed Grebe
•	Double-crested Cormorant
HERONS	
•	Great Blue Heron
•	American Egret
•	Snowy Egret
•	Little Blue Heron
•	Green Heron
•	Black-crowned Night Heron
•	American Bittern
•	Least Bittern
SWANS, GEESE, DUCKS	
•	Whistling Swan
•	Canada Goose
•	Snow Goose
•	Blue Goose
•	Mallard
•	Black Duck
•	Gadwall
•	European Widgeon
•	Baldpate <del>Cinnamon</del> Cinnamon Teal
•	Pintail
•	Green-winged Teal
•	Blue-winged Teal
•	Shoveller
•	Wood Duck
•	Redhead
•	Ring-necked Duck
•	Canvas-back
•	Greater Scaup Duck
•	Lesser Scaup Duck
•	American Golden-eye
•	Buffle-head
•	Old-squaw
•	White-winged Scoter
•	Ruddy Duck
•	Hooded Merganser
•	American Merganser
•	Red-breasted Merganser

VULTURES, HAWKS, FALCONS	
•	Turkey Vulture
•	Sharp-shinned Hawk
•	Cooper's Hawk
•	Red-tailed Hawk
•	Red-shouldered Hawk
•	Broad-winged Hawk
•	Rough-legged Hawk
•	Bald Eagle
•	Marsh Hawk
•	Osprey
•	Duck Hawk
•	Pigeon Hawk
•	Spazzow Hawk <i>nestled</i>
GALLINACEOUS BIRDS	
•	Ruffed Grouse
•	Hungarian Partridge
•	Bob-white
•	Ring-necked Pheasant
MARSH BIRDS	
•	King Rail
•	Virginia Rail
•	Sora
•	Florida Gallinule <i>nesting</i>
•	Coot
SHOREBIRDS	
•	Piping Plover
•	Semipalmated Plover
•	Killdeer
•	Golden Plover
•	Black-bellied Plover
•	Ruddy Turnstone
•	Woodcock
•	Wilson's Snipe <i>nesting</i>
•	Hudsonian Curlew
•	Upland Plover
•	Spotted Sandpiper
•	Solitary Sandpiper
•	Willet
•	Greater Yellowlegs
•	Lesser Yellowlegs
•	Knot
•	Pectoral Sandpiper
•	White-rumped Sandpiper
•	Baird's Sandpiper
•	Least Sandpiper
•	Red-backed Sandpiper <i>nesting</i>
•	Dowitcher
•	Marbled Godwit
•	American Avocet

•	Stilt Sandpiper
•	Semipalmated Sandpiper
•	Western Sandpiper
•	Buff-breasted Sandpiper
•	Sanderling
•	Red Phalarope
•	Wilson's Phalarope
•	Northern Phalarope
GULLS AND TERNS	
•	Glaucous Gull
•	Great Black-backed Gull
•	Herring Gull
•	Ring-billed Gull
•	Franklin's Gull
•	Bonaparte's Gull
•	Forsters Tern
•	Common Tern
•	Chapman Tern
•	Black Tern
DOVES AND PIGEONS	
•	Rock Dove
•	Mourning Dove
CUCKOOS	
•	Yellow-billed Cuckoo
•	Black-billed Cuckoo
OWLS	
•	Barn Owl
•	Screech Owl
•	Great Horned Owl
•	Snowy Owl
•	Barred Owl
•	Long-eared Owl
•	Short-eared Owl
•	Saw-whet Owl
GOATSUCKERS, ETC.	
•	Whip-poor-will
•	Nighthawk
•	Chimney Swift
•	Ruby-throated Hummingbird
•	Belted Kingfisher
WOODPECKERS	
•	Flicker
•	Red-bellied Woodpecker
•	Red-headed Woodpecker
•	Yellow-bellied Sapsucker
•	Hairy Woodpecker
•	Dowdy Woodpecker

<b>FLYCATCHERS</b>			<b>GNATCATCHERS, ETC.</b>			<b>WEAVER BIRDS</b>		
•	•	•	Eastern Kingbird	Blue-gray Gnatcatcher	English Sparrow	•	•	•
•	•	•	Crested Flycatcher	Golden-crowned Kinglet		•	•	•
•	•	•	Phoebe	Ruby-crowned Kinglet		•	•	•
•	•	•	Yellow-bellied Flycatcher	American Pipit		•	•	•
•	•	•	Acadian Flycatcher	Cedar Waxwing		•	•	•
•	•	•	<del>Adler Flycatcher</del> <i>4/22-24</i>	Northern Shrike		•	•	•
•	•	•	Least Flycatcher	Migrant Shrike		•	•	•
•	•	•	Wood Pewee	Starling		•	•	•
•	•	•	Olive-sided Flycatcher			•	•	•
•	•	•	Empidonax			•	•	•
<b>LARKS</b>			<b>VIREOS</b>			<b>BLACKBIRDS AND ORIOLES</b>		
•	•	•	Horned Lark	White-eyed Vireo	Bobolink	•	•	•
<b>SWALLOWS</b>			•	Yellow-throated Vireo	Meadowlark	•	•	•
•	•	•	Tree Swallow	Blue-headed Vireo	Western Meadowlark	•	•	•
•	•	•	Bank Swallow	Red-eyed Vireo	Red-wing Blackbird	•	•	•
•	•	•	Rough-winged Swallow	Philadelphia Vireo	Orebird Oriole	•	•	•
•	•	•	Barn Swallow	Warbling Vireo	<i>Hetemore Oriole Northern</i>	•	•	•
•	•	•	Cliff Swallow		Rusty Blackbird	•	•	•
•	•	•	Purple Martin		Brewer's Blackbird	•	•	•
<b>CROWS AND JAYS</b>					Bronzed Grackle	•	•	•
•	•	•	Blue Jay		Cowbird	•	•	•
•	•	•	Crow			•	•	•
<b>TITMICE, NUTHATCHES, CREEPERS</b>			<b>TANAGERS</b>			<b>FINCHES, SPARROWS, etc.</b>		
•	•	•	Black-capped Chickadee	White Warbler	Cardinal	•	•	•
•	•	•	Tufted Titmouse	Prothonotary Warbler	House-breasted Grosbeak	•	•	•
•	•	•	White-breasted Nuthatch	Golden-winged Warbler	Indigo Bunting	•	•	•
•	•	•	Red-breasted Nuthatch	Blue-winged Warbler	Dickcissel	•	•	•
•	•	•	Brown Creeper	Tennessee Warbler	Evening Grosbeak	•	•	•
<b>WRENS</b>			•	Orange-crowned Warbler	Purple Finch	•	•	•
•	•	•	House Wren	Nashville Warbler	Pine Grosbeak	•	•	•
•	•	•	Winter Wren	Parula Warbler	Redpoll	•	•	•
•	•	•	Bewick's Wren	Yellow Warbler	Pine Siskin	•	•	•
•	•	•	Carolina Wren	Magnolia Warbler	Goldfinch	•	•	•
•	•	•	Long-billed Marsh Wren	Cape May Warbler	Red Crossbill	•	•	•
•	•	•	Short-billed Marsh Wren	Black-throated Blue Warbler	White-winged Crossbill	•	•	•
<b>MOCKINGBIRDS</b>			•	<i>Myrtle Warbler</i> <i>yellow - nape</i>	<i>Red-legged Towhee</i> <i>Kijos - area</i>	•	•	•
•	•	•	Mockingbird	Bar-throated Green Warbler	Savannah Sparrow	•	•	•
•	•	•	Catbird	Gouldian Warbler	Grasshopper Sparrow	•	•	•
•	•	•	Brown Thrasher	Blackburnian Warbler	Henslow's Sparrow	•	•	•
<b>THRUSHES</b>			•	Chestnut-sided Warbler	Sharpen-tailed Sparrow	•	•	•
•	•	•	Robin	Bay-breasted Warbler	Vesper Sparrow	•	•	•
•	•	•	Wood Thrush	Black-tail Warbler	Lark Sparrow	•	•	•
•	•	•	Hermit Thrush	Blue-Wabler	State-colored Junco	•	•	•
•	•	•	olive-backed Thrush	Prarie Wabler	Tree Sparrow	•	•	•
•	•	•	gray-cheeked Thrush	Palm Wabler	Chipping Sparrow	•	•	•
•	•	•	Vireo	Green bird	Feld Sparrow	•	•	•
•	•	•	Bluebird	Northern Water-thrush	White-crowned Sparrow	•	•	•

### FIELD NOTES

Total Species:

Individuals:

July, Aug, Sept. 1987

## FIELD TRIP RECORD

## **Weather:**

## Meteorological Report

**Observers:**

William A. Klamm  
Nancy R. Klamm

**Field Time:**

To:

**From:**

Total:

### **Localities:**

### **Distance: By Car – On Foot**

## Finishes

## Start:

**Total:**

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>GULLS AND TERNS</b>
Common Loon	Turkey Vulture <i>Cathartes</i> <i>frugilegus</i>	Slat Sandpiper
Horned Grebe	Sharp-shinned Hawk	Semipalmated Sandpiper
Pied-billed Grebe	Cooper's Hawk	Western Sandpiper
Double-crested Cormorant <i>in flight</i>	Red-tailed Hawk	Buff-breasted Sandpiper
<b>HERONS</b>	Red-shouldered Hawk	Sanderling
Great Blue Heron	Broad-winged Hawk	Red Phalarope
American Egret	Rough-legged Hawk	Wilson's Phalarope
Snowy Egret	Bald Eagle	Northern Phalarope
Little Blue Heron	Mallard Hawk	
Green Heron	Osprey	
Black-crowned Night Heron	Duck Hawk <i>Accipiter</i> <i>virginicus</i>	
American Bittern	Pigeon Hawk	
Least Bittern	Sparrow Hawk <i>Accipiter</i> <i>richardsonii</i>	
<b>SWANS, GEESE, DUCKS</b>	<b>GALLINACEOUS BIRDS</b>	<b>DOVES AND PIGEONS</b>
Whistling Swan	Ruffed Grouse	Rock Dove
Canada Goose	Hungarian Partridge	Mourning Dove
Snow Goose	Bob-white	
Blue Goose	Ring-necked Pheasant	
Mallard	<b>MARSH BIRDS</b>	<b>CUCKOOES</b>
Black Duck	King Rail	Yellow-billed Cuckoo
Gadwall	Virginia Rail	Black-billed Cuckoo
European Widgeon	Sora	
Baird's Teal	Florida Gallinule <i>Common Moorhen</i>	
Pintail	Coot	
Green-winged Teal	<b>SHOREBIRDS</b>	<b>OWLS</b>
Blue-winged Teal	Piping Plover	Barn Owl
Shoveler	Semipalmated Plover	Screech Owl
Wood Duck	Killdeer	Great Horned Owl
Redhead	Golden Plover	Snowy Owl
Ring-necked Duck	Black-bellied Plover	Barred Owl
Canvas-back	Ruddy Turnstone	Long-eared Owl
Greater Scaup Duck	Woodcock	Short-eared Owl
Lesser Scaup Duck	Wilson's Snipe	Saw-whet Owl
American Golden-eye	Hudsonian Curlew	
Buffle-head	Upland Plover	
Old-squaw	Spotted Sandpiper	
White-winged Scoter	Solitary Sandpiper	
Ruddy Duck	Willet	<b>GOATSUCKERS, ETC.</b>
Hooded Merganser	Greater Yellowlegs	Whip-poor-will
American Merganser	Lesser Yellowlegs	Nighthawk
Red-breasted Merganser	Knot	Chimney Swift
	Pectoral Sandpiper	Ruby-throated Hummingbird
	White-rumped Sandpiper	Belted Kingfisher
	Baird's Sandpiper	
	Least Sandpiper	
	Red-backed Sandpiper	
	Dowitcher	
	<i>American Avocet</i>	<b>WOODPECKERS</b>
	<i>Marbled Godwit</i>	Flicker
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Yellow-bellied Sapsucker
		Hairy Woodpecker
		Downy Woodpecker

FLYCATCHERS		
•	Eastern Kingbird	
•	Crested Flycatcher	
•	Phoebe	
•	Yellow-bellied Flycatcher	
•	Acadian Flycatcher	
•	<i>Altam Flycatcher</i>	<i>Malurus</i>
•	Least Flycatcher	
•	Wood Pewee	
•	Olive-sided Flycatcher	
•	Empidonax	
LARKS		
•	Horned Lark	
SWALLOWS		
•	Tree Swallow	
•	Bank Swallow	
•	Rough-winged Swallow	
•	Barn Swallow	
•	Cliff Swallow	
•	Purple Martin	
CROWS AND JAYS		
•	Blue Jay	
•	Crow	
TITMICE, NUTHATCHES, CREEPERS		
•	Black-capped Chickadee	
•	Tufted Titmouse	
•	White-breasted Nuthatch	
•	Red-breasted Nuthatch	
•	Brown Creeper	
WRENS		
•	House Wren	
•	Winter Wren	
•	Bewick's Wren	
•	Carolina Wren	
•	Lone-hilled Marsh Wren	
•	Short-tailed Marsh Wren	<i>Sedge</i>
MOCKINGBIRDS		
•	Mockingbird	
•	Gathard	
•	Brown Thrasher	
THRUSHES		
•	Robin	
•	Wood Thrush	
•	Hermi Thrush	
•	<i>Blue-bellied Thrush</i>	<i>Swanson</i>
•	Gray-cheeked Thrush	
•	Vireo	
•	Bluebird	

GNATCATCHERS, ETC.		
•	Blue-gray Gnatcatcher	
•	Golden-crowned Kinglet	
•	Ruby-crowned Kinglet	
•	American Pipit	
•	Cedar Waxwing	
•	Northern Shrike	
•	Migrant Shrike	
•	Starling	
VIREOS		
•	White-eyed Vireo	
•	Yellow-throated Vireo	
•	Blue-headed Vireo	<i>Swallow</i>
•	Red-eyed Vireo	
•	Philadelphia Vireo	
•	Warbling Vireo	
WOOD WARBLERS		
•	Black and White Warbler	
•	Prothonotary Warbler	
•	Golden-winged Warbler	
•	Blue-winged Warbler	
•	Tennessee Warbler	
•	Orange-crowned Warbler	
•	Nashville Warbler	
•	Parula Warbler	
•	Yellow Warbler	
•	Magnolia Warbler	
•	Cave May Warbler	
•	Black-throated Blue Warbler	
•	<i>Myrtle Warbler</i>	<i>Yelkuk</i> <i>unsp</i>
•	Black-throated Green Warbler	
•	Carolina Warbler	
•	Blackburnian Warbler	
•	Chestnut-sided Warbler	
•	Bay-breasted Warbler	
•	Black-poll Warbler	
•	Pine Warbler	
•	Prairie Warbler	
•	Palm Warbler	
•	Ovenbird	
•	Northern Water-thrush	
•	Louisiana Water-thrush	
•	Kentucky Warbler	
•	Connecticut Warbler	
•	Mourning Warbler	
•	Yellow-throat	
•	Yellow-breasted Chat	
•	Hoosier Warbler	
•	Wilson's Warbler	
•	Canada Warbler	
•	Redstart	

WEAVER BIRDS		


| BLACKBIRDS AND ORIOLES | | |























































































































































































































































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FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadian Flycatcher
		Alder Flycatcher
		Least Flycatcher
		Wood Pewee
		Olive-sided Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Bewick's Wren
		Carolina Wren
		Long-tailed Marsh Wren
		Short-tailed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Catbird
		Brown Thrasher
THRUSHES		
		Robin
		West. Thrush
		Hermit Thrush
		Olive-backed Thrush
		Gray-backed Thrush
		Vireo
		Bluethroat

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
		American Pipit
		Cedar Waxwing
		Northern Shrike
		Migrant Shrike
		Starling
VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo
WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blue-winged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Parula Warbler
		Yellow Warbler
		Magnolia Warbler
		Cape May Warbler
		Black-throated Blue Warbler
		Myrtle Warbler
		Black-throated Green Warbler
		Geulden Warbler
		Blackburnian Warbler
		Chestnut-sided Warbler
		Yellow-breasted Warbler
		Rock-noll Warbler
		Pine Warbler
		Prarie Warbler
		Palm Warbler
		Ovenbird
		Southern Water-thrush
		Louisiana Water-thrush
		Kentucky Warbler
		Connecticut Warbler
		Mourning Warbler
		Yellow-throat
		Yellow-breasted Chat
		Hooded Warbler
		Wilson's Warbler
		Canada Warbler
		Restart

WEAVER BIRDS		


| BLACKBIRDS AND ORIOLES | | |






| TANAGERS | | |
| FINCHES, SPARROWS, etc. | | |






















































































































































































































































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Jan. Feb., March 1988

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klammer  
Nancy R. Klammer

Field Time:

To:

From:

Total:

Little activity in Jan. Basin area all snow & ice  
Feb: duplicate of Jan. 2 Mockingbirds on the upper  
field on Feb. 29th. Mar. some days snow covered.

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>GULLS AND TERNS</b>
Common Loon	Turkey Vulture	Slat Sandpiper
Horned Grebe	Sharp-shinned Hawk	Semipalmated Sandpiper
Pied-billed Grebe	Cooper's Hawk	Western Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Buff-breasted Sandpiper
	Red-shouldered Hawk	Sanderling
<b>HERONS</b>	Broad-winged Hawk	Red Phalarope
Great Blue Heron	Krough-legged Hawk	Wilson's Phalarope
American Egret	Bald Eagle	Northern Phalarope
Snowy Egret	Marsh Hawk	
Little Blue Heron	Osprey	
Green Heron	Duck Hawk	<b>GULLS AND TERNS</b>
Black-crowned Night Heron	Pigeon Hawk	Glauous Gull
American Bittern	Sparrow Hawk <i>reticulata</i>	Great Black-backed Gull
Least Bittern		Herring Gull
<b>SWANS, GESE, DUCKS</b>	<b>GALLINACEOUS BIRDS</b>	Ring-billed Gull
Whistling Swan	Ruffed Grouse	Franklin's Gull
Canada Goose	Hungarian Partridge	Bonaparte's Gull
Snow Goose	Bob-white	Forster's Tern
Blue Goose	Ring-necked Pheasant	Common Tern
Mallard	<b>MARSH BIRDS</b>	Common Tern
Black Duck	King Rail	Black Tern
Gadwall	Virginia Rail	
European Widgeon	Sora	<b>DOVES AND PIGEONS</b>
Baldpate <i>American Widgeon</i>	Florida Gallinule	Rock Dove
Pintail	Coot	Mourning Dove
Green-winged Teal	<b>SHOREBIRDS</b>	<b>CUCKOOS</b>
Blue-winged Teal	Piping Plover	Yellow-billed Cuckoo
Shoveler	Semipalmated Plover	Black-billed Cuckoo
Wood Duck	Killdeer	
Redhead	Golden Plover	<b>OWLS</b>
Ring-necked Duck	Black-bellied Plover	Barn Owl
Canvas-back	Ruddy Turnstone	Screech Owl
Greater Scaup Duck	Woodcock	Great Horned Owl
Lesser Scaup Duck	Wilson's Snipe 2-30 MYS	Snowy Owl
American Golden-eye	Hudsonian Curlew	Barred Owl
Buffle-head	Upland Plover	Long-eared Owl
Old-squaw	Spotted Sandpiper	Short-eared Owl
White-winged Scoter	Solitary Sandpiper	Saw-whet Owl
Ruddy Duck	Willet	
Hooded Merganser	Greater Yellowlegs	<b>GOATSUCKERS, ETC.</b>
American Merganser	Lesser Yellowlegs	Whip-poor-will
Red-breasted Merganser	Knot	Nighthawk
	Pectoral Sandpiper	Chimney Swift
	White-rumped Sandpiper	Ruby-throated Hummingbird
	Baird's Sandpiper	Belted Kingfisher
	Least Sandpiper	
	Red-backed Sandpiper	<b>WOODPECKERS</b>
	Dowitcher	Flicker
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Yellow-bellied Sapsucker
		Hairy Woodpecker
		Downy Woodpecker

FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadian Flycatcher
		Alder Flycatcher
		Least Flycatcher
		Wood Pewee
		Olive-sided Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Rock Wren
		Carolina Wren
		Long-billed Marsh Wren
		Short-billed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Cather
		Brown Thrasher
THRUSHES		
		Robin
		Wood Thrush
		Hermit Thrush
		Ornate Thrush
		Varied Thrush
		Vireo
		Bluebird

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
		American Pipit
		Cedar Waxwing
		Northern Shrike
		Migrant Shrike
		Starling
VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo
WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blueswinged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Parula Warbler
		Yellow Warbler
		Magnolia Warbler
		Cave May Warbler
		Black-throated Blue Warbler
		Myrtle Warbler
		Black-throated Green Warbler
		Golden-crowned Warbler
		Blackburnian Warbler
		Carolina Warbler
		Bay-breasted Warbler
		Worm-eating Warbler
		Pine Warbler
		Prairie Warbler
		Palm Warbler
		Orange-billed Warbler
		Southern Water-thrush
		Common Water-thrush
		Kentucky Warbler
		Connecticut Warbler
		Mourning Warbler
		Yellowthroat
		Yellow-breasted Chat
		Hesperi Warbler
		Wilson's Warbler
		Canada Warbler
		Restart

WEAVER BIRDS		


| BLACKBIRDS AND ORIOLES | | |






| TANAGERS | | |
| FINCHES, SPARROWS, etc. | | |




















































































































































































































































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Apr. May, June 1988

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klamann  
Nancy R. Klamann

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>SIL SANDPIPER</b>
Common Loon	Turkey Vulture	Semipalmated Sandpiper
Horned Grebe	Sharp-shinned Hawk	Western Sandpiper
Pied-billed Grebe	Cougar Hawk	Buff-breasted Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Sanderling
	Red-shouldered Hawk	Red Phalarope
	Broad-winged Hawk	Wilson's Phalarope
	Rough-legged Hawk	Northern Phalarope
	Bald Eagle	
	Marsh Hawk	
	Osprey	
	Duck Hawk	
	Pukeo Hawk	
	Sparrow Hawk <i>Xanth.</i>	
<b>HERONS</b>	<b>GALLINACEOUS BIRDS</b>	<b>GULLS AND TERN</b>
Great Blue Heron	Ruffed Grouse	Glaucous Gull
American Egret	Hungarian Partridge	Great Black-backed Gull
Snowy Egret	Bob-white	Herring Gull
Little Blue Heron	Ring-necked Pheasant	Ring-billed Gull
Green Heron		Franklin's Gull
Black-crowned Night Heron		Bonaparte's Gull
American Bittern		Forster's Tern
Least Bittern		Common Tern
		Caspian Tern
		Black Tern
<b>SWANS, GESE, DUCKS</b>	<b>MARSH BIRDS</b>	<b>DOVES AND PIGEONS</b>
Whistling Swan	King Rail	Rock Dove
Canada Goose	Virginia Rail	Mourning Dove
Snow Goose	Sora	
Blue Goose	Florida Gallinule	
Mallard	Coot	
Black Duck		<b>CUCKOOS</b>
Gadwall	<b>SHOREBIRDS</b>	Yellow-billed Cuckoo
European Widgeon	Piping Plover	Black-billed Cuckoo
Baldpate <i>Am. Merganser</i>	Semipalmated Plover	
Pintail	Killdeer	
Green-winged Teal	Golden Plover	
Blue-winged Teal	Black-bellied Plover	
Shoveler	Ruddy Turnstone	
Wood Duck	Woodcock	<b>OWLS</b>
Redhead	Wilson's Snipe <i>Centronyx</i>	Barn Owl
Ring-necked Duck	Hudsonian Curlew	Screech Owl
Canvas-back	Upland Plover	Great Horned Owl
Greater Scaup Duck	Spotted Sandpiper	Snowy Owl
Lesser Scaup Duck	Solitary Sandpiper	Barred Owl
American Golden-eye	Willet	Long-eared Owl
Buff-head	Greater Yellowlegs	Short-eared Owl
Old-squaw	Lesser Yellowlegs	Saw-whet Owl
White-winged Scoter	Knot	
Ruddy Duck	Pectoral Sandpiper	<b>GOATSUCKERS, ETC.</b>
	White-rumped Sandpiper	Whip-poor-will
	Baird's Sandpiper	Nighthawk
	Least Sandpiper	Chimney Swift
	Red-breasted Sandpiper <i>Qualeum</i>	Ruby-throated Hummingbird
	Dowitcher	Belted Kingfisher
		<b>WOODPECKERS</b>
		Flicker
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Yellow-bellied Sapsucker
		Hairy Woodpecker
		Downy Woodpecker

FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadian Flycatcher
		Alder Flycatcher <i>Subsp.</i>
		Least Flycatcher
		Wood Pewee
		Olive-sided Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Hewitt's Wren
		Carolina Wren
		Long-billed Marsh Wren
		Short-billed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Gulfbird
		Brown Thrasher
THRUSHES		
		Robin
		Wood Thrush
		Hemmit Thrush
		<del>Green-backed Thrush</del> <i>Acrocephalus</i> <i>griseiceps</i>
		Swainson's Thrush
		Hermit Thrush
		Brewer's Thrush

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
		American Pipit <i>Subsp.</i>
		Cedar Waxwing
		Northern Shrike
		Migrant Shrike
		Starling
VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo
WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blue-winged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Parula Warbler
		Yellow Warbler
		Magnolia Warbler
		Cape May Warbler
		Black-throated Blue Warbler
		<del>Blue</del> Warbler <i>Everglades</i>
		Black-throated Green Warbler
		Golden-crowned Warbler
		Blackburnian Warbler
		Chestnut-sided Warbler
		Bay-breasted Warbler
		Blackpoll Warbler
		Pine Warbler
		Prairie Warbler
		Palm Warbler
		Swainson's Warbler
		Northern Waterthrush
		Louisiana Waterthrush
		Kentucky Warbler
		Connecticut Warbler
		Mourning Warbler
		Yellowthroat
		Yellow-breasted Chat
		Hooded Warbler
		Wilson's Warbler
		Canada Warbler
		Resplendent

WEAVER BIRDS		
		English Sparrow
BLACKBIRDS AND ORIOLES		
		Bobolink
		Meadowlark
		Western Meadowlark
		Redwing Blackbird
		Orchard Oriole
		Baltimore Oriole
		Rusty Blackbird
		Brewer's Blackbird
		<del>Common Grackle Common</del>
		Cowbird
TANAGERS		
		Scarlet Tanager
FINCHES, SPARROWS, etc.		
		Cardinal
		Rose-breasted Grosbeak
		Indigo Bunting
		Dickcissel
		Evening Grosbeak
		Purple Finch
		Pine Grosbeak
		Redpoll
		Pine Siskin
		Goldfinch
		Red Crossbill
		White-winged Crossbill
		Relieved Towhee
		Savannah Sparrow
		Grasshopper Sparrow
		Henslow's Sparrow
		Spurred Towhee
		Varied Sparrow
		Lark Sparrow
		State-colored Junco
		Tree Sparrow
		Chipping Sparrow
		Field L. Sparrow
		White-tailed Sparrow
		White-throated Sparrow
		Fox Sparrow
		Lincoln's Sparrow
		Song Sparrow
		Lucilla Linnet
		Sw. Bunting
		<i>Spurred Finch</i>

## FIELD NOTES

Total Species:

Individuals:

July, Aug 1987

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klamm

Nancy R. Klamm

Field Time:

To:

From:

Total:

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>GULLS AND TERNS</b>
Common Loon	Turkey Vulture	Slat Sandpiper
Horned Grebe	Sharp-shinned Hawk	Semipalmated Sandpiper
Pied-billed Grebe	Cooper's Hawk	Western Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Ruff-breasted Sandpiper
HERONS	Red-shouldered Hawk	Sanderling
Great Blue Heron	Broad-winged Hawk	Red Phalarope
American Egret	Rough-legged Hawk	Wilson's Phalarope
Snowy Egret	Bald Eagle	Northern Phalarope
Little Blue Heron	Marsh Hawk	
Green Heron <i>Accipiter</i> <i>flavipes</i>	Osprey	
Black-crowned Night Heron	Duck Hawk	
American Bittern	Pigeon Hawk	
Least Bittern	Sparrow Hawk <i>Kite</i>	
<b>SWANS, GEESE, DUCKS</b>	<b>GALLINACEOUS BIRDS</b>	<b>DOVES AND PIGEONS</b>
Whistling Swan	Ruffed Grouse	Rock Dove
Canada Goose	Hungarian Partridge	Mourning Dove
Snow Goose	Bob-white	
Blue Goose	Ring-necked Pheasant	
Mallard	<b>MARSH BIRDS</b>	<b>CUCKOOS</b>
Black Duck	King Rail	Yellow-billed Cuckoo
Gadwall	Virginia Rail	Black-billed Cuckoo
European Widgeon	Sora	
Baldpate	<i>Limosa haemastica</i>	
Pintail	Coot	
Green-winged Teal	<b>SHOREBIRDS</b>	<b>OWLS</b>
Blue-winged Teal	Piping Plover	Barn Owl
Shoveller	Semipalmated Plover	Screech Owl
Wood Duck	Killdeer	Great Horned Owl
Redhead	Golden Plover	Snowy Owl
Ring-necked Duck	Black-bellied Plover	Barred Owl
Canvas-back	Ruddy Turnstone	Long-eared Owl
Greater Scaup Duck	Woodcock	Short-eared Owl
Lesser Scaup Duck	Wilson's Snipe	Saw-whet Owl
American Golden-eye	Hudsonian Curlew	
Buffle-head	Upland Plover	
Old-squaw	Shotted Sandpiper	
White-winged Scoter	Solitary Sandpiper	
Ruddy Duck	Willet	
Hooded Merganser	Greater Yellowlegs	
American Merganser	Lesser Yellowlegs	
Red-breasted Merganser	Knot	
	Pectoral Sandpiper	
	White-rumped Sandpiper	
	Baird's Sandpiper	
	Least Sandpiper	
	Red-backed Sandpiper	
	Dowitcher	
	<i>american</i> <i>curvirostra</i>	
		<b>GOATSUCKERS, ETC.</b>
		Whip-poor-will
		Nighthawk
		Chimney Swift
		Ruby-throated Hummingbird
		Belted Kingfisher
		<b>WOODPECKERS</b>
		Flicker
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Yellow-bellied Sapsucker
		Hairy Woodpecker
		Downy Woodpecker

FLYCATCHERS		
		Eastern Kingbird
		Crested Flycatcher
		Phoebe
		Yellow-bellied Flycatcher
		Acadian Flycatcher
		Alder Flycatcher <i>W. w.</i>
		Least Flycatcher
		Wood Pewee
		Olive-sided Flycatcher
		Empidonax
LARKS		
		Horned Lark
SWALLOWS		
		Tree Swallow
		Bank Swallow
		Rough-winged Swallow
		Barn Swallow
		Cliff Swallow
		Purple Martin
CROWS AND JAYS		
		Blue Jay
		Crow
TITMICE, NUTHATCHES, CREEPERS		
		Black-capped Chickadee
		Tufted Titmouse
		White-breasted Nuthatch
		Red-breasted Nuthatch
		Brown Creeper
WRENS		
		House Wren
		Winter Wren
		Bewick's Wren
		Carolina Wren
		Long-billed Marsh Wren
		Short-billed Marsh Wren
MOCKINGBIRDS		
		Mockingbird
		Catherd
		Brown Thrasher
THRUSHES		
		Robin
		Wood Thrush
		Hermit Thrush
		Olive-backed Thrush
		Gray-cheeked Thrush
		Vireo
		Bluethroat

GNATCATCHERS, ETC.		
		Blue-gray Gnatcatcher
		Golden-crowned Kinglet
		Ruby-crowned Kinglet
		American Pipit
		Cedar Waxwing
		Northern Shrike
		Migrant Shrike
		Starling
VIREOS		
		White-eyed Vireo
		Yellow-throated Vireo
		Blue-headed Vireo <i>Solitaria</i>
		Red-eyed Vireo
		Philadelphia Vireo
		Warbling Vireo
WOOD WARBLERS		
		Black and White Warbler
		Prothonotary Warbler
		Golden-winged Warbler
		Blue-winged Warbler
		Tennessee Warbler
		Orange-crowned Warbler
		Nashville Warbler
		Parula Warbler
		Yellow Warbler
		Magnolia Warbler
		Cape May Warbler
		Black-throated Blue Warbler
		Myrtle Warbler
		Black-throated Green Warbler
		Cerulean Warbler
		Blackburnian Warbler
		Chestnut-sided Warbler
		Bay-breasted Warbler
		Blackpoll Warbler
		Pine Warbler
		Prairie Warbler
		Palm Warbler
		Ovenbird
		Northern Waterthrush
		Louisiana Waterthrush
		Kentucky Warbler
		Connecticut Warbler
		Mourning Warbler
		Yellowthroat
		Yellow-breasted Chat
		Hooded Warbler
		Wilson's Warbler
		Canada Warbler
		Restart
WEAVER BIRDS		
		English Sparrow
BLACKBIRDS AND ORIOLES		
		Bobolink
		Meadowlark
		Western Meadowlark
		Red-wing Blackbird
		Orchard Oriole
		Baltimore Oriole
		Rusty Blackbird
		Brewer's Blackbird
		<del>Bohemian</del> Grackle <i>Quiscalus</i>
		Cowbird
TANAGERS		
		Scarlet Tanager
FINCHES, SPARROWS, etc.		
		Cardinal
		Rose-breasted Grosbeak
		Indigo Bunting
		Dickcissel
		Evening Grosbeak
		Purple Finch
		Pine Grosbeak
		Redpoll
		Pine Siskin
		Goldfinch
		Red Crossbill
		White-winged Crossbill
		Red-eyed Towhee
		Savannah Sparrow
		Grasshopper Sparrow
		Henslow's Sparrow
		Sharptailed Sparrow
		Vesper Sparrow
		Lark Sparrow
		Altocolored Junco
		Tree Sparrow
		Chipping Sparrow
		Field Sparrow
		White-crowned Sparrow
		White-throated Sparrow
		Fox Sparrow
		Lincoln's Sparrow
		Swamp Sparrow
		Song Sparrow
		Lazuli Linnet
		Indigo Bunting
		<i>Hespero. fuscicollis</i>

## FIELD NOTES

Total Species:

Individuals:

Sept 1988

## FIELD TRIP RECORD

Weather:

Meteorological Report

Observers:

William A. Klammer  
Nancy R. Klammer

Field Time:

To: Since there was approx 1" of rain at the end of Aug., there were casual some water, therefore double check same flock.  
From:  
Total: Since we left on Sept., there have been no ducks.

Localities:

Distance: By Car — On Foot

Finish:

Start:

Total:

Day & Date:

<b>WATER BIRDS</b>	<b>VULTURES, HAWKS, FALCONS</b>	<b>SUL Sandpiper</b>
Common Loon	Turkey Vulture	Semipalmated Sandpiper
Horned Grebe	Sharp-shinned Hawk	Western Sandpiper
Pied-billed Grebe	Copper Hawk	Ruff-breasted Sandpiper
Double-crested Cormorant	Red-tailed Hawk	Sanderling
HERONS	Red-shouldered Hawk	Red Phalarope
Great Blue Heron	Broad-winged Hawk	Wilson's Phalarope
American Egret	Rough-legged Hawk	Northern Phalarope
Snowy Egret	Bald Eagle	
Little Blue Heron	Marsh Hawk	
Green-Heron	Owl	
Black-crowned Night Heron	Duck Hawk	
American Bittern	Pigeon Hawk	
Least Bittern	Sparrow Hawk (Yard)	
<b>SWANS, GESE, DUCKS</b>	<b>GALLINACEOUS BIRDS</b>	<b>GULLS AND TERNS</b>
Whistling Swan	Ruffed Grouse	Glaucous Gull
Canada Goose	Hungarian Partridge	Great Black-backed Gull
Snow Goose	Bob-white	Herring Gull
Blue Goose	Ring-necked Pheasant	Ring-billed Gull
Mallard	MARSH BIRDS	Franklin's Gull
Black Duck	King Rail	Bonaparte's Gull
Gadwall	Virginia Rail	Forster's Tern
European Widgeon	Sora	Common Tern
Baldpate <del>Imperial</del> Merganser	Florida Gallinule	Caupan Tern
Pintail	Coot	Black Tern
Green-winged Teal	<b>SHOREBIRDS</b>	<b>DOVES AND PIGEONS</b>
Blue-winged Teal	Piping Plover	Rock Dove
Shoveller	Semipalmated Plover	Mourning Dove
Wood Duck	Killdeer	<b>CUCKOOS</b>
Redhead	Golden Plover	Yellow-billed Cuckoo
Ring-necked Duck	Black-bellied Plover	Black-billed Cuckoo
Canvas-back	Ruddy Turnstone	
Greater Scaup Duck	Woodcock	<b>OWLS</b>
Lesser Scaup Duck	Wilson's Snipe	Barn Owl
American Golden-eye	Hudsonian Curlew	Screech Owl
Buffle-head	Upland Plover	Great Horned Owl
Old-squaw	Spotted Sandpiper	Snowy Owl
White-winged Scoter	Solitary Sandpiper	Barred Owl
Ruddy Duck	Willet	Long-eared Owl
Hooded Merganser	Greater Yellowlegs	Short-eared Owl
American Merganser	Lesser Yellowlegs	Saw-whet Owl
Red-breasted Merganser	Knot	<b>GOATSUCKERS, ETC.</b>
	Pectoral Sandpiper	Whip-poor-will
	White-rumped Sandpiper	Nighthawk
	Baird's Sandpiper	Chimney Swift
	Least Sandpiper	Ruby-throated Hummingbird
	Red-backed Sandpiper	Belted Kingfisher
	Dowitcher	<b>WOODPECKERS</b>
		Flicker
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Yellow-bellied Sapsucker
		Hairy Woodpecker
		Downy Woodpecker

FLYCATCHERS		
•	Eastern Kingbird	
•	Crested Flycatcher	
•	Phoebe	
•	Yellow-bellied Flycatcher	
	Acadian Flycatcher	
	Alder Flycatcher	
	Least Flycatcher	
	Wood Pewee	
	Olive-sided Flycatcher	
	Empidonax	
LARKS		
	Horned Lark	
SWALLOWS		
•	Tree Swallow	
•	Bank Swallow	
•	Rough-winged Swallow	
•	Barn Swallow	
•	Cliff Swallow	
•	Purple Martin	
CROWS AND JAYS		
	Blue Jay	
	Crow	
TITMICE, NUTHATCHES, CREEPERS		
	Black-capped Chickadee	
	Tufted Titmouse	
	White-breasted Nuthatch	
	Red-breasted Nuthatch	
	Brown Creeper	
WRENS		
•	House Wren	
	Winter Wren	
	Bewick's Wren	
	Carolina Wren	
•	Long-billed Marsh Wren	
	Short-billed Marsh Wren	
MOCKINGBIRDS		
•	Mockingbird	
•	Catbird	
•	Brown Thrasher	
THRUSHES		
•	Robin	
	Wood Thrush	
	Hermit Thrush	
•	Gray-cheeked Thrush <i>Swarren</i>	
	Vireo	
	Bluebird	

GNATCATCHERS, ETC.		
	Blue-gray Gnatcatcher	
	Golden-crowned Kinglet	
	Ruby-crowned Kinglet	
	American Pipit	
	Cedar Waxwing	
	Northern Shrike	
	Migrant Shrike	
	Starling	
VIREOS		
	White-eyed Vireo	
	Yellow-throated Vireo	
	Blue-headed Vireo	
	Red-eyed Vireo	
	Philadelphia Vireo	
	Warbling Vireo	
WOOD WARBLERS		
•	Black and White Warbler	
	Prothonotary Warbler	
	Golden-winged Warbler	
	Blue-winged Warbler	
	Tennessee Warbler	
	Orange-crowned Warbler	
	Nashville Warbler	
	Parula Warbler	
	Yellow Warbler	
	Magnolia Warbler	
	Cape May Warbler	
	Black-throated Blue Warbler	
	<del>Swainson's Warbler</del> <i>yellow-rumped</i>	
	Black-throated Green Warbler	
	Cerulean Warbler	
	Blackburnian Warbler	
	Chestnut-sided Warbler	
	Bay-breasted Warbler	
	Blackpoll Warbler	
	Pine Warbler	
	Prairie Warbler	
	Palm Warbler	
	Ovenbird	
	Northern Waterthrush	
	Louisiana Waterthrush	
	Kentucky Warbler	
	Connecticut Warbler	
	Mourning Warbler	
	Yellowthroat	
	Yellow-breasted Chat	
	Bearded Warbler	
	Wilson's Warbler	
	Canada Warbler	
	Redstart	

WEAVER BIRDS		


| BLACKBIRDS AND ORIOLES | | |






| TANAGERS | | |
| FINCHES, SPARROWS, etc. | | |





















































































































































































































































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**APPENDIX E**  
**SAGINAW, MI, CDF BOTULISM CONTROL MANAGEMENT PLAN**  
**(Includes an excerpt from the 1982 Saginaw CDF Operations Manual  
referring to botulism control.)**

**CONFINED DISPOSAL FACILITY  
BOTULISM CONTROL MANAGEMENT PLAN  
SAGINAW, MICHIGAN  
JANUARY, 1982**

**I. DATA GATHERING PHASE**

**Saginaw Bay CDF Monitoring Plan**

1. Site visits: Once per 2 weeks starting when temperatures reach the mid-60's (around 15 April). Once per week starting mid-June.
2. Monitoring team will consist of at least one person from the Corps and one person from the Michigan Department of Natural Resources (MDNR).
3. Corps will provide boat.
4. Corps will provide instruments to measure temperature and dissolved oxygen (DO).
5. Personnel will walk the perimeter of at least the north dike.
6. Measurements of temperature and DO will be made of any accessible ponded water.
7. Inspectors should indicate on map of CDF (using a new map every week):
  - a) Locations of birds:
    1. Numbers & types (species) estimated.
    2. Conditions of birds.
  - b) Note on map: mud areas, ponded water, mud crack areas, dry-firm areas.
  - c) Note on map: areas with vegetation.
  - d) Other general comments should be written at bottom of map or attached, including climate conditions.
8. Inspectors will take 12 photos each trip showing general condition of the facility.

**II. REACTION PHASE**

**Saginaw Bay CDF Immediate Response Plan**

1. If the monitoring team reports sick or dead birds or other individuals report sick or dead birds, the Corps and MDNR will react immediately.
2. Initial contacts are Stanley R. Jacek, Corps of Engineers (313-226-6796) and Daniel Morgan, MDNR 8-253-3930 (517-373-3930).
- 3a. Sick and dead birds collected will be provided to the MDNR field representative, and MDNR laboratories will make the determination of whether or not botulism is present in the affected birds.
- 3b. Response will include an increase in field visits to two or more times per week to remove dead birds.

4. If botulism is found by the MDNR to be the problem, exploders will be put into operation - up to nine on the north cell dike. (If more exploders are needed, borrow from FWS, and purchase more).

5. Experiments with placement of imitation snow owls on rafts will be accomplished. Owls to be provided by the MDNR Roscommon Office.

6. Additionally, a determination would be made as to whether or not operational changes should be made as a response. These changes could include:

- a. Stopping dredging.
- b. Pumping more fresh water after each dredge load discharge.

### **III. LONG-RANGE OPERATIONAL PHASE**

#### **Saginaw Bay CDF Operational Plan**

This plan is predicated on the knowledge that water management practices within the disposal site are the key to the successful control of the toxin-producing bacteria.

This plan includes the following:

##### **1. Date of Material Placement**

- a. Place material into the CDF as late in the year as practicable. Cold weather (less than 68° F) inhibits production of the toxin. Not discharging into the CDF will keep sediments dry, thus inhibiting bacterial growth.
- b. Fall material placement has an added advantage of holding back the protein substitute (organics in the dredge material which the bacteria need) until after it is too late in the year for the bacteria to grow.

##### **2. Planned Distribution of Dredged Material Within the Dikes**

- a. Place material directly into the low areas (presently on the east side) during dredging operations. This would allow the mud flats to dry out, and keep a water layer over the most recently placed material.
- b. Movement of material after initial dredge placement by use of small hydraulic dredge placed within CDF.

##### **3. Drying of Sediments Within the CDF**

- a. Evaporative drying will remove water from the upper few inches of dredged material by capillary resupply of the soil, resulting in crust formation. This aids precipitation runoff via desiccation cracks.
- b. Good surface drainage, rapidly removing precipitation and preventing ponding of surface water, accelerates evaporative drying. The most efficient method of promoting good surface drainage is by constructing drainage trenches in the disposal area.\*

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\* EM 1110-2-5007 18 Dec 1978.

- c. A dragline could be used to form a perimeter trench, 12 to 15 ft inside the dike, 6 to 8 ft wide, and 12 to 24 in. deep. Operations would normally begin at the weir, digging a sump, extending into the disposal area using maximum boom and bucket reach. Because the material is already piled to the top of the weir, at Saginaw, it would probably be best to allow it to drain to the east side into the existing pool, and pump that pool down to lake level if necessary. The excavated material would be cast on the interior slope of the perimeter dike.
  - d. Interior drainage via drainage trenches should be initiated when perimeter trenching decreases fluid consistency of dredged material below the thin drying skin to allow trench construction to a significant depth, and support capacity of the soil allows conventional low ground pressure construction equipment to enter the disposal area to construct the trenches.
  - e. After the above trenching has dried the top dike crust out sufficiently, a conventional dragline may be placed in the CDF on mats and trenching may take place at 4-month intervals.
  - f. Once a crust of 25 in. is achieved a small dragline may be able to operate with mats.
4. Surface trenching and drying not only decrease the chance for botulism, but help prevent mosquito problems, and firm up the soil for future use of the facility. Drying the sediments also increases CDF capacity. On a large-scale basis, costs of creating disposal volume by progressive surface trenching range from \$0.10/yd<sup>3</sup> to \$0.30/yd<sup>3</sup> (1977 dollars).\*

#### **IV. STUDY PHASE**

- 1. Use of consultants to provide recommendations on dike management to minimize botulism outbreaks.
  - a. WES - Presently we have contacted the US Army Engineer Waterways Experiment Station (WES) at Vicksburg, MS. A representative from WES is scheduled to make a site visit to Saginaw in April. This site visit will provide the basis for immediate advice and a longer range study of disposal area management to minimize outbreaks of botulism.

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\* Technical Report EL-81-11, Dec 1981, pg 137.

**EXCERPT FROM:**  
**OPERATION AND MAINTENANCE MANUAL**  
**SAGINAW RIVER CONFINED DISPOSAL FACILITY**  
**LAKE HURON, MICHIGAN**  
**1982**

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\* This portion of the original text has been reproduced here as pp E8-E9.

## 27. BOTULISM CONTROL

- a. General - Botulism poisoning occurs as a result of ingestion of toxin produced by the bacterium *Clostridium botulinum*. The conditions for growth are simply: warm temperature, animal protein food supply, and high moisture content or water.

There are now six known types of botulism, each type designated by a letter (A-F) but all are strains of the same bacterium. Type C is responsible for most waterfowl mortalities. Types A, B, E, and F affect humans while D affects cattle. Type E, in addition to causing human disease, also causes losses of some water-associated birds in the Great Lakes area.\*

Perched ponds and mud flats with warm stagnant water and dead fish or invertebrates brought up with dredged material facilitate botulism and should be avoided. The most effective method of preventing botulism is to manage the CDF with the objective of drying the dredged sediments, and to maintain close surveillance of the CDF during periods of high potential for botulism.

- b. Botulism Surveillance Period - If mud flats are present, botulism can occur when temperatures reach the mid 60s. Therefore, inspections of the CDF should be made periodically between 15 June and 31 October. Between 15 June and 1 August inspections should be made at least once every 2 weeks. During the most critical botulism season, 1 August thru 31 October, inspections should be made at least once per week. Botulism sickness in waterfowl can be identified by the following symptoms which are a result of the extent to which the central nervous system is paralyzed:

- (1) The bird is unable to fly but may still be able to swim or walk.
- (2) The bird can only sit, or flop on the ground, often not even being able to raise its head. In this case the bird will die from lack of food and water but could survive if given fresh water and protected from direct sunlight and predators.

If dead or sick ducks are found in the facility, the following actions should be taken immediately:

- (1) Contact Mr. Don Bilmaier, Chief, Operations and Maintenance Branch, 313-226-6796, who will contact the MDNR field representative.
- (2) Bury all carcasses immediately, or place carcasses in plastic bags and remove from the site. (A single decomposing carcass (animal, fish, or bird) can produce enough botulism-infected maggots to kill many waterfowl.)
- (3) Sick birds collected shall be given water and provided to the MDNR field representative for determination of whether or not botulism is present in the affected birds.

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\* Resources Agency of California. 1971. "Waterfowl Botulism Management," Wildlife Management Leaflet No. 14, Sacramento, CA.

- c. If botulism is found to be the problem, the Chief, Operations and Maintenance Branch will direct the appropriate response in accordance with the Detroit District "Botulism Control Management Plan" prepared for the Saginaw CDF.